UNIVERSITY OF
ILLINOIS LIBRARY
AT URBANA-CHAMPAIGN
BOOKSTACKS

Doc;
I 1.94/2:
16/1

BOOKSTACKS
DOCUMENTS

134-65

PB83-910201

DEPOSITORY

MAR 7 1983

UNIVERSITY OF ILLINOIS

HERTZBERG – NEW METHOD, INC. EAST VANDALIA ROAD, JACKSONVILLE, ILL. 62650

TITLE NO.	ACCOUNT NO.	LOT AND TICKET NO.
S-0471.360(P2	07200-134	CO 54- 65 P

43-12 SELECTED * WATER * RESOURCES * ABSTRACTS *

43-24 160JAN.-APR.*1983

42-28 DOC.* I 1.94/2:

16/1-48

CLOTH COLOR

HEIGHT

CHARGING INFORMATION				HEIGHT	PICA	WRAP
STUBBING		FRONT COVER				
HAND SEW		NO TRIM				
THRU SEW		PAGES LAMINATED				
THRU SEW ON TAPE		EXTRA THICKNESS				
HAND ADHESIVE		MAP POCKET PAPER				
LENGTHWISE		MAP POCKET CLOTH		SPECIAL WORK AND PREP.		
FOREIGN TITLE		SPECIAL WORK				
LINES OF LETTERING						

DP4

B

81418

SELECTED WATER RESOURCES ABSTRACTS

VOLUME 16, NUMBER 1
JANUARY 1983

W83-00001 -- W83-00350
CODEN: SWRABW

Doc.
I 1.94/2:
16/1

BOOKSTACKS
DOCUMENTS

134-65

PB83-910201

DEPOSITORY
MAR 7 1983
UNIVERSITY OF ILLINOIS
AT URBANA-CHAMPAIGN

SELECTED WATER RESOURCES ABSTRACTS

VOLUME 16, NUMBER 1
JANUARY 1983

W83-00001 -- W83-00350
CODEN: SWRABW

SELECTED WATER RESOURCES ABSTRACTS (SWRA) is produced by the Geological Survey, U.S. Department of the Interior, and published monthly by the National Technical Information Service (NTIS), U.S. Department of Commerce.

SWRA is available to Federal agencies and their contractors or grantees in water resources research upon request, citing contract or grant number and sponsoring agency. Write: Water Resources Division, U.S. Geological Survey, MS 421, Reston, VA 22092, U.S. Department of the Interior, Washington, DC 20240. The **SWRA Journal** is also available on subscription from NTIS, 5285 Port Royal Road, Springfield, VA 22161. Annual subscription rates for the North American Continent are:
Journal only, $100; Journal and Annual Indexes, $125; Indexes only, $50. Other addressees, write for prices.

Some documents abstracted in this journal can be purchased from NTIS. Price codes are given in the entries and a current code-price conversion table is printed on the outside back cover. Other documents are available from originating organizations or authors as indicated in the citation.

SELECTED WATER RESOURCES ABSTRACTS

A monthly publication of the Geological Survey
U.S. Department of the Interior

VOLUME 16, NUMBER 1
JANUARY 1983

W83-00001 -- W83-00350

The Secretary of the Interior has determined that the publication of the periodical is necessary in the transaction of the public business required by law of this Department.

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.

PREFACE

Selected Water Resources Abstracts, a monthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. These documents cover water resources as treated in the life, physical, and social sciences and the related engineering and legal aspects of the characteristics, supply condition, conservation, control, use, or management of water resources. Each abstract includes a full bibliographic citation and a set of descriptors which are listed in the **Water Resources Thesaurus.** The abstract entries are classified into 10 fields and 60 groups similar to the water resources research categories established by the Committee on Water Resources Research of the then Federal Council for Science and Technology.

Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientitsts, engineers, and managers as one of several services of the Water Resources Scientific Information Center. The cumulative SWRA file from 1968 and monthly updates are available also in magnetic tape through lease from NTIS.

THE WATER RESOURCES SCIENTIFIC INFORMATION CENTER DOES NOT PROVIDE COPIES OF DOCUMENTS ABSTRACTED IN THIS JOURNAL. Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources.

Comments and suggestions concerning the contents and arrangement of this bulletin are welcome.

Water Resources Scientific
Information Center
U.S. Geological Survey, MS 421
Reston, VA 22092

CONTENTS

SUBJECT FIELDS AND GROUPS

Please use the edge index on the back cover to locate Subject Fields and Indexes.

01 NATURE OF WATER

Includes the following Groups: Properties; Aqueous Solutions and Suspensions.

02 WATER CYCLE

Includes the following Groups: General; Precipitation; Snow, Ice, and Frost; Evaporation and Transpiration; Streamflow and Runoff; Groundwater; Water in Soils; Lakes; Water in Plants; Erosion and Sedimentation; Chemical Processes; Estuaries.

03 WATER SUPPLY AUGMENTATION AND CONSERVATION

Includes the following Groups: Saline Water Conversion; Water Yield Improvement; Use of Water of Impaired Quality; Conservation in Domestic and Municipal Use; Conservation in Industry; Conservation in Agriculture.

04 WATER QUANTITY MANAGEMENT AND CONTROL

Includes the following Groups: Control of Water on the Surface; Groundwater Management; Effects on Water of Man's Nonwater Activities; Watershed Protection.

05 WATER QUALITY MANAGEMENT AND PROTECTION

Includes the following Groups: Identification of Pollutants; Sources of Pollution; Effects of Pollution; Waste Treatment Processes; Ultimate Disposal of Wastes; Water Treatment and Quality Alteration; Water Quality Control.

06 WATER RESOURCES PLANNING

Includes the following Groups: Techniques of Planning; Evaluation Process; Cost Allocation, Cost Sharing, Pricing/Repayment; Water Demand; Water Law and Institutions; Nonstructural Alternatives; Ecologic Impact of Water Development.

07 RESOURCES DATA

Includes the following Groups: Network Design; Data Acquisition; Evaluation, Processing and Publication.

08 ENGINEERING WORKS

Includes the following Groups: Structures; Hydraulics; Hydraulic Machinery; Soil Mechanics; Rock Mechanics and Geology; Concrete; Materials; Rapid Excavation; Fisheries Engineering.

09 MANPOWER, GRANTS, AND FACILITIES

Includes the following Groups: Education—Extramural; Education—In-House; Research Facilities; Grants, Contracts, and Research Act Allotments.

10 SCIENTIFIC AND TECHNICAL INFORMATION

Includes the following Groups: Acquisition and Processing; Reference and Retrieval; Secondary Publication and Distribution; Specialized Information Center Services; Translations; Preparation of Reviews.

SUBJECT INDEX

AUTHOR INDEX

ORGANIZATIONAL INDEX

ACCESSION NUMBER INDEX

SELECTED WATER RESOURCES ABSTRACTS

2. WATER CYCLE

2A. General

STOCHASTIC DAILY PRECIPITATION MODELING AND DAILY STREAMFLOW TRANSFER PROCESSES,
Purdue Univ. Lafayette, IN. Water Resources Research Center.
For primary bibliographic entry see Field 2E.
W83-00282

RAINFALL-RUNOFF CHARACTERISTICS FOR A MOUNTAINOUS WATERSHED IN THE NORTHEAST UNITED STATES,
Agricultural Research Service, Beltsville, MD. Hydrology Lab.
E. T. Engman.
Nordic Hydrology, Vol 12, No 4/5, p 247-264, 1981. 7 Fig, 6 Tab, 16 Ref.

Descriptors: Rainfall-runoff relationships, *Mountains, *Watersheds, Hydrologic models, Runoff volume, Regression analysis, Mathematical studies, Storm runoff, Northeastern United States, *Vermont.

Basic hydrological processes in the mountainous and glaciated upland areas of the northeastern United States are being studied in an instrumented research watershed near Danville, Vermont. One aspect of this investigation is the description of the basic climatic and rainfall-runoff relationships as they apply to mountain hydrology. Rainfall-runoff relationships in this area were found to be characterized by fast response but relatively low runoff volumes, with little evidence of surface runoff. The partial area concept described by Dunne and Black (1970), in which the partial or source areas consist of saturated or near saturated regions adjacent to the stream which are the sources of storm runoff, appears to describe the storm runoff process in these watersheds. The contributing areas for storms in nine watersheds varying from about 0.5 to 112 square kilometers were calculated using a partial area model developed by Lee and Delleur (1976). Regression analysis with several variables showed that the calculated partial areas could be explained to a great degree by the amount of baseflow at the beginning of the storm. These results demonstrated the feasibility of generalizing the partial area representation to large areas. (Carroll-FRC)
W83-00347

2B. Precipitation

THE TOXICOLOGY OF SILVER IODIDE IN RELATION TO ITS USE AS A CLOUD SEEDING AGENT,
Department of Water Affairs, Pretoria (South Africa); Hydrological Research Inst., Pretoria (South Africa).
P. L. Kempster.
Technical Report No TR 100, September 1979. 14 p, 3 Tab, 29 Ref.

Descriptors: *Cloud seeding, *Artificial precipitation, *Poisons, *Silver iodide, *Environmental effects, Silver, Weather modification, Toxicity, Hazardous materials, Heavy metals, Iodides, Iodine, Halogens, Solubility, Surveys, Rainfall, Rainfall area, Local precipitation, Chemistry of precipitation, Precipitation, Feasibility studies.

The potential toxicity resulting from the use of silver iodide (AgI) as a cloud-seeding agent was assessed, relative to knowledge of the reported effects of silver (Ag) and iodine (I) occurring in the environment. The extreme dilution of added AgI in resultant precipitation taken together with its inherent insolubility makes the possibility of poisoning from AgI fallout highly unlikely. It is concluded that there is no danger of either Ag or I toxicity from the use of AgI as a cloud-seeding agent. Nonetheless, a complete accurate record of the total mass of AgI used each year and the total area over which this mass is distributed should be maintained to assure the attainment of rational decisions with respect to AgI use. The 7 tons of AgI (containing 4 tons of I) released over a 6-year period over an experimental cloud-seeding area is small relative to the several hundred tons of I naturally contained in the 10 sq km ground area of question. Further, an increase in the background level of I would provide a moderate I intake increase that would be beneficial and serve to protect against thyroid disorders. Also, with respect to Ag, insoluble Ag compounds such as AgI have a low toxic potential. (Zielinski-MAXIMA)
W83-00084

THE ANALYSES OF AREAL RAINFALL USING MULTI-QUADRIC SURFACES,
Department of Water Affairs, Pretoria (South Africa). Div. of Hydrology.
P. T. Adamson.
Technical Report No. 82, September, 1978. 25 p, 7 Fig, 15 Ref, 1 Append.

Descriptors: *Areal precipitation, *Computer programs, *Mathematical studies, *Terrain analysis, *Theroretical analysis, Precipitation, Computer models, Model studies, Surface flow, Surface runoff, Topographic mapping, Topography, Rainfall, Mathematical models, Subsurface mapping, Simulation analysis.

The theory, use, and specifications are described for a multi-quadric surface-fitting computer program. Multi-quadric analysis offers an analytical approach to the representation of an irregular surface and is appropriate to the application of areal rainfall surfaces. Two examples are provided: one, involving the areal analysis of a 5-day storm; the other, a regional evaluation of annual mean rainfall. The advantage of multi-quadric analysis is its efficiency, when combined with plotting capability, to produce accurate contour maps objectively and rapidly. The program also is capable of integrating the volume beneath the surface under study while preserving the shape of the study area. Further, while the analytical procedure does not perform well for mountainous areas, dummy coordinates can be introduced provided a suitable relationship between rainfall and altitude is available. In addition, maps can be scaled in such a way that they overlay standard topographical sheets. The multi-quadric computer program listing and a sample output are provided. Two typical quadric surfaces consider the use of circular hyperboloids and paraboloids. (Zielinski-MAXIMA)
W83-00088

FACTORS CONTROLLING STABLE ISOTOPE COMPOSITION OF EUROPEAN PRECIPITATION,
Heidelberg Univ. (Germany, F.R.). Inst. of Environmental Physics.
K. Rozanski, C. Sonntag, and K. O. Munnich.
Tellus, Vol 34, No 2, p 142-150, April, 1982. 6 Fig, 24 Ref.

Descriptors: *Isotope studies, *Precipitation, *Isotope fractionation, *Mathematical models, Simulation analysis, Evapotranspiration, Water vapor, Temperature, Europe.

A simple multibox model of the mean west-east horizontal transport of the atmospheric water vapor across the European continent has been used to simulate the seasonal and spatial variations of stable isotope ratios in present day European precipitation. Isotope fractionation during the formation of precipitation leads to an increasing depletion of heavy isotopes in the residual air moisture as it moves towards the center of the continent. Evapotranspiration compensates for part of this isotope depletion, particularly in summer. Data for the period 1960 through 1980 which were used to develop model estimates include horizontal water vapor flux data and monthly precipitation, evapotranspiration, and surface air temperature data available for various locations in Europe. The model was able to reproduce both continental and seasonal temperature effects observed in the stable isotope composition of European precipitation fairly well. Regional scale processes, such as water vapor transport patterns into the continent and average precipitation-evapotranspiration history of air masses precipitating in a given location, were found to be the major contributors to the isotope composition of local precipitation. Local parameters had only a slight influence on the isotope ratios. These model predictions have several implications for the interpretation of stable isotope ratios in earlier periods as preserved in ice cores and in groundwater. (Carroll-FRC)
W83-00176

CLIMATIC ASPECTS OF DROUGHTS,
Maryland Univ., College Park. Dept. of Meteorology.
For primary bibliographic entry see Field 3F.
W83-00188

A DEPTH-DURATION-FREQUENCY DIAGRAM FOR POINT RAINFALL IN SWA-NAMIBIA,
University of the Witwatersrand, Johannesburg (South Africa). Hydrological Research Unit.
W. V. Pitman.
Water SA, Vol 6, No 4, p 157-162, October, 1980. 5 Fig, 3 Tab, 4 Ref.

Descriptors: *Depth-area-duration analysis, *Weather forecasting, *Hydraulic structures, *Data collections, *Data interpretation, Rainfall intensity, Precipitation intensity, Rainfall-runoff relationships, Rainfall impact, Rainfall, Rainstorms, Prediction, Projections, Hydraulic engineering, Design criteria, Data processing, South Africa, *Namibia.

Information on extreme rainfall is a basic requirement for the design of hydraulic structures, but no study had been undertaken for hydraulic structure designers for SWA-Namibia, who usually had to rely on doubtful extrapolations from the South African data. Hence, methods were adopted and results obtained in an analysis of extreme one-day point rainfalls in this region. From an analysis of available daily and autographic rainfall data an isohetal map and coaxial diagram were compiled for SWA-Namibia. From the coaxial diagram and map, it was possible to estimate (for a specified recurrence interval) the maximum likely precipitation for any duration between one-tenth of an hour and one day. From this approach, designers can estimate point rainfalls of this duration (6 minutes to 24 hours) with return periods from 2-100 years at any location in SWA-Namibia. Records from 572 daily-read rain gauges were transferred to computer cards. Data from seven official autographic recording stations in, and two outside of, SWA-Namibia were used to disaggregate daily to short-duration rainfall extremes. After appropriate corrections, the data set comprising about 120,000 computer cards was transferred onto magnetic tape for analysis, interpretation, and prediction. (Zielinski-MAXIMA)
W83-00289

2C. Snow, Ice, and Frost

FINITE ELEMENT GLACIER DYNAMICS MODEL APPLIED TO COLUMBIA GLACIER, ALASKA,
Geological Survey, Tacoma, WA. Water Resources Div.
W. G. Sikonia.
Available from Supt. of Documents, GPO, Washington, DC 20402, Price, $5.00. Professional Paper 1258-B, 1982. 74 p, 9 Fig, 2 Tab, 12 Ref, 5 Append.

Descriptors: *Glaciers, *Computer models, *Computer programs, *Finite element method, *Continuity equation, Flow, Ice, Viscous flow, Rheology, Boundaries, Moraines, Ice-water interfaces, *Alaska, Calving, Glacial retreat.

A two-dimensional finite element computer model describes the dynamics of glacier flow, and includes the flow of ice, sliding, calving of the terminus, and surface balance. Surface profile and terminus position are followed in time. A calving law which relates calving speed to water discharge at the bed of the glacier and to the height of the ice

column unsupported by water pressure, is shown to fit observed calving at Columbia Glacier. Application of the flow model to Columbia Glacier indicates catastrophic, rapid retreat from the terminal moraine beginning in 1983. (USGS)
W83-00118

CONTINUITY EQUATION MODEL OF THE PREDICTED DRASTIC RETREAT OF COLUMBIA GLACIER, ALASKA,
Geological Survey, Tacoma, WA. Water Resources Div.
L. A. Rasmussen, and M. F. Meier.
Available from Supt. of Documents, GPO, Washington, DC 20402, Price, $3.50. Professional Paper 1258-A, 1982. 23 p, 22 Fig, 3 Tab, 12 Ref.

Descriptors: *Glaciers, *Continuity equation, *Computer models, *Glacier mass balance, Prediction, Icebergs, Ablation, Velocity, *Alaska, *Columbia Glacier, Calving, Glacier retreat.

A one-dimensional numerical model based on the continuity equation is developed to predict the retreat rate of the terminus of Columbia Glacier, Alaska, and to estimate the time distribution of the iceberg discharge. The retreat of the terminus is expressed in terms of the difference between the glacier flux to the terminus and the iceberg flux from the terminus. The continuity equation is applied to the lower 14 kilometers of the glacier to determine the ice flux to the terminus as the sum of the ice flux into the lower reach of the glacier and the flux increment resulting from the thinning of the lower reach not due to ablation. The iceberg flux is assumed to be proportional to the average water depth at the terminus. All calculations are performed on annualized data. A sequence of longitudinal profiles is supplied; the model then determines the times at which the glacier assumes each of the profiles. The effect on the predicted retreat rate caused by the arbitrariness of the longitudinal profiles appears to be less than the effect of other uncertainties in the data used. The predicted retreat slowly accelerates from the initial observed rate of 45 meters per year until 1983.0 + or - 0.9, when the terminus reaches deep water, and the retreat rate rapidly increases to about 4 kilometers per year. A maximum iceberg calving flux of about 10 cubic kilometers per year, which is 6 to 8 times the initial amount, is expected to occur in about 1983. (USGS)
W83-00119

2D. Evaporation and Transpiration

PINE TREE EVAPOTRANSPIRATION,
Florida Univ., Gainesville. School of Forest Resources and Conservation.
H. Riekerk.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-108167, Price codes: A03 in paper copy, A01 in microfiche. Water Resources Research Center, University of Florida, Publication No 62, Gainesville, March, 1982. 37 p, 10 Fig, 1 Tab, 80 Ref, 1 Append. OWRT A-039-FLA(1),14-34-0001-9010/0110/1110.

Descriptors: *Evapotranspiration, Evapotranspiration control, Evapotranspiration potential, *Pine trees, *Evaporation rate, *Seasonal variation, *Mathematical equations, Lysineters, Moisture meters, Aeration zone, Mathematical studies, Mathematical models, Correlation analysis, Statistical methods, Stochastic process.

An experimental study was conducted to evaluate the relationship of the Penman equation of potential evaporation (PE) to actual evapotranspiration (ET) data from a developing flatwoods pine plantation. Daily atmospheric demand data from weather station information were compared with daily ET data from a nearby weighing lysimeter installation placed in a young pine plantation. The installation was in poorly-drained soil, and had a sensitivity of about 0.5 mm water. Average seasonal ET was 2.4, 1.2, and 5.7 mm/day for the autumn, winter, and spring months, respectively. Equipment failures produced by high humidity and lightening damage prevented reliable ET data collection for the summer. The PE was calculated from the Penman equation using the weather station data; total PE was 1440 mm for the year of measurement. Seasonal ratios of measured ET to calculated PE were 0.92, 0.44, and 0.89 for the autumn, winter, and spring months, respectively. Prediction of ET seasonal rates by the Penman method was good for the autumn and spring seasons. Water use during the spring drought lowered the water table below the rooting zone. Soil water drawn by roots from the unsaturated zone rapidly became limiting for slash pine transpiration until summer rains raised the water table again. (Zielinski-MAXIMA)
W83-00279

A WEIGHING LYSIMETER FACILITY AT ROODEPLAAT FOR CROP EVAPOTRANSPIRATION STUDIES,
Soil and Irrigation Research Inst. Pretoria, (South Africa). Dept. of Agricultural Technical Services.
J. L. Hutson, and G. C. Green.
Water SA (Pretoria), Vol 6, No 1, p 41-46, January, 1980. 3 Fig, 1 Tab, 20 Ref.

Descriptors: *Lysimeters, *Evapotranspiration potential, *Design criteria, *Irrigation practices, *Crop yield, Moisture meters, Evapotranspiration, Crop production, Consumptive use, Data processing, Soil water, Soil moisture meters, Moisture, Rainfall, Monitoring, Irrigation, Calibrations, *South Africa.

Design features of four recording lysimeters installed 30 km north of Pretoria are described, each consisting of a 2 m by 2 m by 1 m steel tank supported on a counter-balanced lever system. Water content changes were monitored by means of an electronic load beam. Calibration data indicated that hourly evapotranspiration (ET) can be measured to about 0.1 mm water. ET and other environmental parameters were monitored and recorded by a data-logging system. Two years of continuous operation have shown the lysimeter system to be accurate and reliable. In conjunction with other available monitoring facilities at the test site, the lysimeters should prove valuable tools for enhancing awareness of the interaction between soil, water, and atmosphere. Tests were conducted on a crop rotation of wheat in summer and soya beans in winter. The data obtained from the bysimeters gave hourly average water balance of wheat during the growing season, as well as cumulative ET values for 24 hour periods. Calculated calibration constants for the lysimeter design showed that the response of the lysimeters was linear and stable over time and that resolution of about 2.5 microvolts (0.1 mm water) was feasible. Calibration constants are periodically checked to ensure data quality and reliability. (Zielinski-MAXIMA)
W83-00287

MEASUREMENT AND MAPPING OF POTENTIAL EVAPOTRANSPIRATION IN A SMALL MOUNTAINOUS WATERSHED,
Strasbourg-1 (France).
G. Najjar, B. Ambroise, and J. L. Mercier.
Nordic Hydrology, Vol 12, No 4/5, p 195-206, 1981. 6 Fig, 10 Ref.

Descriptors: *Evapotranspiration potential, *Watersheds, *Mountains, Measurement techniques, Evapotranspiration, Mapping, Solar radiation.

A method has been developed for measuring and mapping evapotranspiration in any mountainous watershed, where the evapotranspiration pattern is considerably influenced by topographic structure. The method involves the use of Brochet and Gerbier's formula, which is derived from Penman's equation for evapotranspiration, in estimating potential evapotranspiration. The method has been applied to the Ringelbach watershed in the Vosges Mountains of France, where climatologic, hydrologic, and geomorphologic processes and their interactions at watershed level have been studied since 1976. Maps of daily evapotranspiration were calculated with the formula by mapping daily global radiation and the Piche evaporation under shelter. Maps of daily global radiation were computed for sunny days from horizontally measured global solar radiation, taking into account slopes, aspects, and orographic masks. Small and cheap Piche shelters, specially designed and calibrated, were implanted over the whole watershed, with the Piche evaporation under shelter measured twice daily. Important differences within the watershed were found in daily global radiation, Piche evaporation under shelter, and potential evapotranspiration. The spatial patterns among these three factors were dependent on weather type, topographic structure, and soil surface humidity. The mapping procedure, which is easy to apply, provides a good tool for estimating potential evapotranspiration at different scales of space and time from a few point measurements. Use of the method is topoclimatic and hydrologic studies at watershed level in mountainous areas provides assistance in choosing a climatic station truly representative of the watershed climate, provides reliable information for use in spatially-distributed hydrologic models, and permits good insight into the topoclimatic structure of the watershed. (Carroll-FRC)
W83-00346

2E. Streamflow and Runoff

LOW FLOW OF STREAMS IN FAIRFAX COUNTY, VIRGINIA,
Geological Survey, Fairfax, VA. Water Resources Div.
For primary bibliographic entry see Field 4C.
W83-00062

FLOODFLOW CHARACTERISTICS RELATED TO CHANNEL GEOMETRY IN OHIO,
Geological Survey, Columbus, OH. Water Resources Div.
E. E. Webber, and J. W. Roberts.
Available from the OFSS, USGS Box 25425, Fed. Ctr. Denver, CO 80225, Price: $4.25 in paper copy, $3.50 in microfiche. Open-File Report 81-1105, 1981. 28 p, 7 Fig, 3 Tab, 21 Ref.

Descriptors: *Streamflow, *Floods, *Flood flow, *Flow characteristics, Alluvial channels, Channel morphology, Channel flow, Estimating, Flood frequency, Flood peak, Natural streams, Open channels, Flood recurrence interval, Bankfull stage, Gaging stations, Sites, Geomorphology, Hydrologic data, *Ohio.

Techniques for estimating magnitude and frequency of flood-peak discharges, based on channel-geometry parameters, are presented as a method for evaluating Ohio floods. Peak discharges for 2-, 5-, 10-, 25-, 50-, and 100-year floods at 160 natural flow gaging stations are correlated with the active-channel stream width at each station. The 160 stations are distributed throughout the State and range from 0.12 to 7,422 square miles in drainage area. Six peak discharge estimating equations were developed, one for each frequency of flooding given above, and the standard errors of estimate range from 42 to 55%. (USGS)
W83-00067

POTENTIAL FLOOD AND DEBRIS HAZARDS AT COTTONWOOD COVE, LAKE MEAD NATIONAL RECREATION AREA, CLARK COUNTY, NEVADA,
Geological Survey, Carson City, NV. Water Resources Div.
O. Moosburner.
Available from the OFSS, USGS Box 25425, Fed. Ctr. Denver, CO 80225, Price: $3.50 in paper copy, $4.00 in microfiche. Open-File Report 80-1216, 1981. 11 p, 2 Fig, 1 Plate, 1 Tab, 4 Ref.

Descriptors: *Flash floods, *Hazards, *Detritus, *Recreation, Flood frequency, Dikes, Flood routing, Flood control, Maximum probable flood, Flood damage, Sediments, *Nevada, Lake Mead National Recreation area, Cottonwood Cove, Lake Mohave.

At Cottonwood Cove, Nevada, most of the existing dikes at the recreation sites are effective in

diverting and routing floodflows, up to and including the 100-year flood, away from people and facilities. The dikes across Ranger Residence Wash and Access Road Wash at the mouth divert floods up to the 50-year recurrence interval away from residential areas. Flow and debris damage in protected areas will be relatively minor minor for floods including the 100-year flood, whereas damage caused by sediment deposition at the mouths of the washes near Lake Mohave could be significant for floods equal to or less than the 100-year flood. The extreme flood, a flood meteorologically and hydrologically possible but so rare as to preclude a frequency estimate, could cause great damage and possible loss of life. The present dikes would be topped or breached by such flooding. (USGS)
W83-00070

ANNUAL PEAK DISCHARGES FROM SMALL DRAINAGE AREAS IN MONTANA THROUGH SEPTEMBER 1981,
Geological Survey, Helena, MT. Water Resources Div.
R. J. Omang, C. Parrett, and J. A. Hull.
Available from the OFSS, USGS Box 25425, Fed. Ctr. Denver, CO 80225, Price: $15.75 in paper copy, $4.50 in microfiche. Open-File Report 82-270, March 1982. 112 p, 2 Fig, 4 Ref.

Descriptors: *Flood peak, *Small watersheds, *Floods, *Flood frequency, Surface runoff, Crest gages, Streamflow, Flow rates, Hydrologic data, *Montana, Missouri River basin, Columbia River basin.

Annual peak stage and discharge data have been collected and tabulated for crest-stage gaging sites in Montana. The crest-stage program was begun in July 1955 to investigate the magnitude and frequency of floods from small drainage areas. The program has expanded from 45 crest-stage gaging stations initially to 172 stations maintained in 1981. Data in the report are tabulated for the period of record. (USGS)
W83-00071

THE STATISTICS OF EXTREME VALUES AND THE ANALYSES OF FLOODS IN SOUTH AFRICA,
Department of Water Affairs, Pretoria (South Africa). Div. of Hydrology.
P. T. Adamson.
Append.

Descriptors: *Theoretical analysis, *Floods, *South Africa, *Statistical methods, *Flood forecasting, Mathematical studies, Statistical analysis, Statistics, Drainage engineering, Structural engineering, Computer programs, Computer models, Flood recurrence interval, Dam design, Rainfall intensity, Excess rainfall, Spillways, Flood profiles, Flood peak.

An introduction to the theoretical background of extreme-value analysis is presented in a manner that simplifies its understanding and use for practicing engineers. The fundamentals of the theory are described such that can be readily understood by the practicing engineer who desires, for example, to design a dam spillway and would also like to know how the answer was arrived at, its limitations, and what confidence he can apply to it. Certain conclusions are drawn from the different methods applied and from the results for South African data. These conclusions should provide a basis for the scientific study of floods in South Africa. In addition, the description and specifications of a computer program written for the routine analysis of annual flood peaks is provided, along with desk calculation procedures and examples. None of the methods presented require more than a simple calculator and the use of the tables provided. The computer program merely provides and plots the results more rapidly and marginally more accurately than desk calculation by means of iteration and interpolation techniques, in addition to offering additional statistics for the interpretation of results. Although confined to floods, the methodology is readily applicable to rainfall maxima and, with minor adjustment, to droughts. (Zielinski-MAXIMA)
W83-00089

PERENNIAL-STREAMFLOW CHARACTERISTICS RELATED TO CHANNEL GEOMETRY AND SEDIMENT IN MISSOURI RIVER BASIN,
Geological Survey, Lawrence, KS. Water Resources Div.
For primary bibliographic entry see Field 4D.
W83-00121

STREAMFLOWS AND CHANNELS OF THE GREEN RIVER BASIN, WYOMING,
Geological Survey, Cheyenne, WY. Water Resources Div.
For primary bibliographic entry see Field 4A.
W83-00122

INVESTIGATION OF TRENDS IN FLOODING IN THE TUG FORK BASIN OF KENTUCKY, VIRGINIA, AND WEST VIRGINIA,
Geological Survey, Reston, VA. Water Resources Div.
For primary bibliographic entry see Field 4A.
W83-00128

ASSESSMENT OF THE USEFULNESS OF HYDROLOGIC DATA FOR HYDROPOWER FEASIBILITY ANALYSIS,
Idaho Univ., Moscow. Dept. of Civil Engineering.
C. C. Warnick, L. F. Heitz, and J. R. Filler.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-108555, Price codes: A04 in paper copy, A01 in microfiche. Idaho Water and Energy Resources Research Institute, Completion Report, Idaho University, Moscow, June, 1982. 43 p, 15 Fig, 7 Tab, 9 Ref. OWRT A-068-IDA(1), 14-34-0001-1114.

Descriptors: *Hydrologic data, *Feasibility studies, *Flow duration, *Streamflow, *Computer programs, Assessment, Hydrologic data collections, Hydrologic models, Hydrologic systems, Gaging, Hydraulics, Hydrodynamics, Mathematical studies, Correlation analysis, Drainage basins, Flow measurement, *Idaho, Clearwater River basin, Salmon River basin.

Methods were examined for extrapolating gaged flow information to ungaged locations, which might improve the capability for flow estimations in examining hydropower potential, and might be useful in hydropower feasibility studies. Such methods have been defined. Parametric flow duration (FD) curves were developed from streamflow data measured for various streams in two large Idaho drainage basins (Clearwater River and Salmon River basins). Comparison studies defined the general limits of curve extrapolation, and indicated the necessary flow data input for making acceptable FD analysis. The economic consequences of using different predicted values of flow duration were demonstrated. Study of FD curves for individual months showed that there is considerable variation in FD curve shape from month to month. Dimensionless FD curves could be used to predict FD, once the monthly average flow data were calculated. Dimensionless flow deviation plots of 12 small gaged streams in Horsecreek watershed (Clearwater River basin) showed a similar pattern of the FD curves, and again showed what wide variation in flow values can be expected for particular exceedance percentages. There is relatively less variation in flow values at the 30% exceedance value. Computer programs were used to assist engineering and economic assessments. (Zielinski-MAXIMA)
W83-00251

IIHR DISTRUBUTED PARAMETER WATERSHED MODEL,
Iowa Univ., Iowa City. Iowa Inst. of Hydraulic Research.
S. C. Jain, S. Kumar, G. Whelan, and T. E. Croley, II.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-108084, Price codes: A11 in paper copy, A01 in microfiche. Iowa Institute of Hydraulic Research Report No 244, June, 1982. 232 p, 38 Fig, 12 Tab, 6 Append. OWRT B-064-IA(1), 14-34-0001-9072.

Descriptors: *Watersheds, *IIHR watershed model, *Hydrologic models, *Computer models, *Parametric hydrology, Model studies, Catchment areas, Catchment basins, Model testing, Flood hydrographs, Flood models, Hyetographs, Infiltration coefficient, Rainfall, Overland flow, Channel flow, Sediment transport, *Iowa, Ralston Creek.

A model is presented which describes a catchment in fine detail by retaining individual characteristics throughout the watershed, and which includes consideration of overland and channel models of water and sediment flows. Specifically considered is the application of the Soil Conservation Service infiltration model to compute rainfall excess hyetographs, flood modeling, watershed sedimentation modeling, and an application to Ralston Creek. The watershed is divided along tributary divides into subcatchments, which are then divided along steepest slope lines into 'streamtubes' which are further partitioned into planar elements by slope that retain individual characteristics (slope, width, land-use/soil characteristics, rainfall input, etc.). Hence, overland flows begin at the tributary divide and enter the channel at the midpoint of the streamtube (node). Channel routing is then performed from node to node via natural channel shapes on the premise that lateral inflows can be adequately represented by the inflows at the nodes. Overland and channel flows are numerically analyzed. The sediment-continuity equation is solved following the flow computations. The flood model was verified on the 3.01 sq mile Ralston Creek watershed; the sediment model will be tested later. (Zielinski-MAXIMA)
W83-00269

STOCHASTIC DAILY PRECIPITATION MODELING AND DAILY STREAMFLOW TRANSFER PROCESSES,
Purdue Univ. Lafayette, IN. Water Resources Research Center.
T. J. Chang, M. L. Kavvas, and J. W. Delleur.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-108191, Price codes: A13 in paper copy, A01 in microfiche. Technical Report No 146, June 1982. 268 p, 90 Fig, 32 Tab, 78 Ref, 3 Append. OWRT B-112-IND(1), 14-34-0001-0219.

Descriptors: *Precipitation, *Stochastic process, *Mathematical studies, *Floods, *Drought, *Daily hydrographs, Rainfall-runoff relationships, Rainfall, Streamflow, Streamflow forecasting, Model studies, Probabilistic process, Correlation analysis, Computer models, Computer programs, Estimating equations.

Research studies were carried out to examine the behavior of floods and droughts, and to provide characteristics of run lengths of wet and dry periods which are used to physically interpret flood and drought properties. This was approached through the modeling of daily hydrological series, with the models applied to several Indiana locations. Two newly-defined stochastic processes are constructed: the binary discrete autoregressive moving average (modeling the wet-dry precipitation sequence) mixed with an exponential distribution to express the precipitation magnitude (B-DARMA-E); and the multi-stage discrete autoregressive moving average process (M-DARMA). Both processes are used to model daily precipitation time series in Indiana. A 3-step procedure (identification, estimation, diagnostic checking) was formulated for modeling by the two processes. Identification, using the autocorrelation function has engineering convenience; estimation, through preservation of the auto-correlations, is suitable for stochastic processes; diagnostic checking, using run length distribution, is shown to statistically efficient. Run length distributions for the two processes are defined and derived. Finally, the transfer discrete autocoregressive moving average model (T-DARMA) is conceptually constructed for the daily precipitation-stream-flow transfer process, based on known properties of the B-DARMA-E or

M-DARMA precipitation model. (Zielinski-MAXIMA)
W83-00282

2F. Groundwater

THE HYDROTHERMAL SYSTEM IN SOUTHERN GRASS VALLEY, PERSHING COUNTY, NEVADA,
Geological Survey, Carson City, NV. Water Resources Div.; and Geological Survey, Menlo Park, CA. Water Resources Div.
For primary bibliographic entry see Field 4B.
W83-00060

APPLICATIONS OF DIGITAL MODELING FOR EVALUATING THE GROUND-WATER RESOURCES OF THE '2,000-FOOT' SAND OF THE BATON ROUGE AREA, LOUISIANA,
Geological Survey, Baton Rouge, LA. Water Resources Div.
For primary bibliographic entry see Field 4B.
W83-00109

DEEP ARTESIAN AQUIFERS OF SANIBEL AND CAPTIVA ISLANDS, LEE COUNTY, FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
For primary bibliographic entry see Field 4B.
W83-00114

SUMMARY APPRAISALS OF THE NATION'S GROUND-WATER RESOURCES--NEW ENGLAND REGION,
Geological Survey, Reston, VA. Water Resources Div.
For primary bibliographic entry see Field 4B.
W83-00120

DESIGNATION OF PRINCIPAL WATER-SUPPLY AQUIFERS IN MINNESOTA,
Geological Survey, St. Paul, MN. Water Resources Div.
D. G. Adolphson, J. F. Ruhl, and R. J. Wolf.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-215534, Price codes: A03 in paper copy, A01 in microfiche. Water-Resources Investigations 81-51, August 1981. 19 p, 9 Fig, 1 Tab, 19 Ref.

Descriptors: *Groundwater, *Water quality, *Aquifers, *Water supply, Water wells, Water demand, Aquifer characteristics, Dissolved solids, *Minnesota, Twin Cities basin.

Fourteen aquifers, ranging from Precambrian to Quaternary in age, have been identified as the principal sources of water to wells in Minnesota. Half the municipal population and nearly all the rural population depend on water from these aquifers. Buried and surficial sand and gravel aquifers of Quarternary age occur in nearly all areas of the State. The State's ground water generally contains less than 1,000 milligrams per liter dissolved solids, except in the extreme southwest, northeast, and western areas. Saline water is present at depth throughout the State. Six principal water-quality types are present in the aquifers. Calcium magnesium bicarbonate type water, the most common, is generally present throughout the upper part of the ground-water system. (USGS)
W83-00125

ESTIMATED EFFECTS OF PROJECTED GROUND-WATER WITH-DRAWALS ON MOVEMENT OF THE SALTWATER FRONT IN THE FLORIDAN AQUIFER, 1976-2000, WEST-CENTRAL FLORIDA,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 4B.
W83-00130

GROUNDWATER IN THE INNER BLUEGRASS KARST REGION, KENTUCKY,
Kentucky Water Resources Research Inst., Lexington.
J. Thrailkill, L. E. Spangler, W. M. Hopper, Jr., and J. W. Troester.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-108126. Research Report No 136, August, 1982. 136 p, 10 Fig, 4 Tab, 67 Ref, 6 Append. OWRT B-064-KY(1), 14-34-0001-9115.

Descriptors: *Kentucky, *Environmental tracers, *Groundwater basins, *Groundwater movement, *Geohydrology, Kentucky Bluegrass Karst Region, Bluegrasses, Groundwater, Tracers, Dye releases, Sink drains, Subsurface water, Aquifers, Groundwater pollution, Limestone, Springs.

The use of water tracing and other techniques served to characterize the hydrogeology of about 12% of the Inner Bluegrass Karst Region (5600 sq km) of central Kentucky. Using fluorescent dyes (sorbed on fabric and charcoal detectors), 96 traces (average length, 2.7 km; maximum length, 15 km) resulted in the identification of 38 groundwater basins having areas up to 15 sq km. Subsurface basin flow is in a dendritic conduit system at depths of 30 m or more below the surface; flow in the interbasin areas separating the basins is generally less than 5 m deep. Each groundwater basin discharges at a spring whose average discharge is about 20 liters/second/sq m of basin area. The limestone underlying the region is thin-bedded with shale partings and argillaceous units. Within groundwater basins, sinkhole drains and other conduits have breached the shales, and descend (almost verically) to a level determined by equilibrium flow in the larger conduits. The general location and flow directions in the groundwater basins are probably determined by potentiometric gradient prior to conduit development, and some basins are localized by regional elements; otherwise, lithologic/structural factors have little influence on subsurface flow. (Zielinski-MAXIMA)
W83-00275

2G. Water In Soils

SOIL SURVEY OF THE EXPERIMENTAL CATCHMENTS NEAR BETHLEHEM,
Department of Water Affairs, Pretoria (South Africa). Hydrological Research Inst., Pretoria (South Africa).
For primary bibliographic entry see Field 4D.
W83-00087

SOIL MAPS OF MONTANA,
Montana State Univ., Bozeman. Dept. of Plant and Soil Science.
For primary bibliographic entry see Field 7C.
W83-00237

ADJUSTMENT OF SOIL LIMITATIONS,
Stellenbosch Univ. (South Africa).
J. J. Lambrechts.
The Deciduous Fruit Grower (Cape Town), Vol 30, No 9, p 330-339, September, 1980. 2 Tab, 4 Ref.

Descriptors: *Soil properties, *Soil-water-plant relationships, *Soil stabilization, *Soil treatment, *Drainage, *Mathematical equations, Soil physical properties, Soil moisture retention, Soil water, Soil texture, Soil water potential, Saline soils, Acidic soils, Alkaline soils, Metals, Soil management, Acidity, Surface drainage, Subsoil drainage, Soil density, *South Africa.

Adjustment measures taken to eliminate or ameliorate soil limitations are discussed. Primary factors individually considered are: limited usable soil depth, soil wetness, brackish soils, soil texture gradients, soil acidity, and inherent soil density. The associated limitations of these soil limitations for crop cultivation and general corrective measures are described. For soils which have limited usable depth, crops (e.g., pears) tolerant to such a limitation can be selected as an alternative to crops which would require an expensive drainage system with regular maintenance (e.g., peaches). Effective soil depth on slightly/moderately sloping sites can be increased by topsoil ridging. Excessively wet soils can be improved by use of appropriate drainage improvement. Saline sandy soils can only be corrected by leaching and removal of the salty leaching water; generally, artificial drainage is usually essential for desalination. Sodic-magnesic soils present a greater problem, and calcium application is needed to replace sodium and magnesium. Crisscross plowing with mixing action is needed for soils having texture gradients. Slaked lime is useful to correct for soil acidity. Two mathematical expressions for calculating soil lime requirements are given. (Zielinski-MAXIMA)
W83-00286

2H. Lakes

CONTROL OF LAKE PHOSPHORUS WITH ALUMINUM SULFATE: DOSE DETERMINATION AND APPLICATION TECHNIQUES,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Lab.
For primary bibliographic entry see Field 5C.
W83-00006

MASS BALANCE MODEL ESTIMATION OF PHOSPHORUS CONCENTRATIONS IN RESERVOIRS,
Bureau of Reclamation, Denver, CO. Engineering Research Center.
For primary bibliographic entry see Field 5C.
W83-00009

DISTRIBUTION OF DENITRIFYING BACTERIA AND ITS CONTROLLING FACTORS IN FRESHWATER ENVIRONMENTS,
Tokyo Metropolitan Univ. (Japan). Dept. of Biology.
For primary bibliographic entry see Field 5C.
W83-00018

A PRINCIPAL COMPONENTS ANALYSIS OF THE PHYTOPLANKTON FROM A POND IN THE PARANA RIVER VALLEY, ARGENTINA,
Instituto Nacional de Limnologia, Santo Tome (Argentina).
For primary bibliographic entry see Field 5C.
W83-00022

APPLICABILITY OF PHOSPHORUS BUDGET MODELS TO SOUTHERN AFRICAN MAN-MADE LAKES,
National Inst. for Water Research, Pretoria (South Africa). Limnology Div.
For primary bibliographic entry see Field 5C.
W83-00025

EXISTENCE OF PHYTOPLANKTON IN SPIRIT LAKE NEAR ACTIVE VOLCANO MT. ST. HELENS, WASHINGTON, U.S.A.: POST-ERUPTION FINDINGS,
Army Engineer District, Portland, OR.
For primary bibliographic entry see Field 5C.
W83-00026

SEASONAL VARIATION OF ZOOPLANKTON OF THE VELI LAKE, SOUTH-WEST COAST OF INDIA,
Kerala Univ., Trivandrum (India). Dept. of Aquatic Biology and Fisheries.
M. Arunachalam, O. Divakaran, N. Balakrishnan Nair, and N. K. Balasubramanian.
Archiv fur Hydrobiologie, Vol 93, No 3, p 359-374, February, 1982. 9 Fig, 2 Tab, 15 Ref.

Descriptors: *Zooplankton, *Invertebrates, *Seasonal variation, Veli Lake, *India, Lakes, Nematodes, Annelids, Monsoons, Crustaceans, Copepods, Oligochaetes, Mollusks, Fish, Tropical regions, Brackish water, Flooding, Water temperature, Salinity, Water properties, Oxygen, Insects.

Veli Lake, a tropical backwater lake on India's southwest coast, has periodic access to the Arabian Sea during monsoonal flooding. The potential of

this water for fisheries and aquaculture was assessed by documenting the seasonal fluctuations in the environment and zooplankton. Temperature, salinity, and oxygen levels were 26.9-32.3C, 0.2-4.8 o/oo, and 3.3-4.9 mg per liter, respectively. The zooplankton population was a combination of marine, brackish water, and fresh water types, mostly nematodes, annelids, arthropods, mollusks, and fish larvae. Crustaceans were most numerous, with copepods being dominant. Other important components were oligochaetes, insect larvae, and fish larvae. At the station closest to the sea, densities were greatest during the monsoon and post-monsoon periods. At the more inland station, densities were highest premonsoon, late monsoon, and post-monsoon. (Cassar-FRC)
W83-00027

PALEOECOLOGICAL STUDIES OF THE RECENT DEVELOPMENT OF THE LAKE VAXJOSJON. IV. INTERPRETATION OF THE EUTROPHICATION PROCESS THROUGH THE ANALYSIS OF SUBFOSSIL CHIRONOMIDS,
Uppsala Univ. (Sweden). Dept. of Entomology.
For primary bibliographic entry see Field 5C.
W83-00028

EFFECTS OF THE BURROWING MAYFLY, HEXAGENIA, ON NITROGEN AND SULFUR FRACTIONS IN LAKE SEDIMENT MICROCOSMS,
State Univ. of New York Coll. of Environmental Science and Forestry, Syracuse. Dept. of Environmental and Forest Biology.
For primary bibliographic entry see Field 5C.
W83-00030

DISTRIBUTION OF CHIRONOMIDS IN THE LITTORAL ZONE OF LAKE TEXOMA, OKLAHOMA AND TEXAS,
Oklahoma Univ., Norman. Dept. of Zoology.
C. C. Vaughn.
Hydrobiologia, Vol 89, No 2, p 177-188, April, 1982. 5 Fig, 3 Tab, 59 Ref.

Descriptors: *Reservoirs, *Salinity, *Midges, *Littoral zone, Population dynamics, Hydrobiology, Population density, Aquatic populations, Species composition, Species diversity, Particulate matter, Organic matter, Wind, Water temperature, *Oklahoma, Lake Texoma, *Texas.

Lake Texoma, a large reservoir in southcentral Oklahoma, was formed by the impoundment of the Washita and Red Rivers. The Red River is greater in salinity than the Washita and forms a complex salinity gradient across the reservoir. During the spring and summer of 1978, chironomid populations were monitored with multi-plate samplers in areas of high, intermediate, and low salinity. The distribution of the 14 genera and at least 22 species of chironomids present was affected by food availability, temperature, salinity and wind direction. Filter feeders were most dense in river-arm stations where levels of particulate organic matter were high, while algal grazers attained their highest densities in the clear intermediate area. As the water temperature and the density of Glyptotendipes sp. increased, most genera feeding primarily on particulate organic matter decreased. The confinement of certain species to either the Red River arm or the Washita River arm suggests differences in salinity tolerance by chironomids. (Geiger-FRC)
W83-00031

PHYSICOCHEMICAL LIMNOLOGY OF THE TONGUE RIVER RESERVOIR, MONTANA,
Alaska Univ., Fairbanks. Inst. of Marine Science.
S. C. Whalen, S. A. Leathe, R. W. Gregory, and J. C. Wright.
Hydrobiologia, Vol 89, No 2, p 161-176, April, 1982. 10 Fig, 6 Tab, 55 Ref.

Descriptors: *Physicochemical properties, *Hydrologic regime, *Nutrients, *Reservoirs, Heat budget, Phosphorus, Nitrogen, Outlets, Advection, Ions, Limnology, Tongue River, *Montana.

A one year physicochemical survey was conducted on the Tongue River Reservoir, a mature medium-sized Northern Great Plains reservoir characterized by a deep-water outlet. The only significant inflow was the Tongue River, which supplied 93% of the nutrient inputs, 96% of the major ions and 97% of the water input to the impoundment. Heat advected from inflowing water comprised 17% of the energy gained during the summer heating cycle. Fluvial contributions to the annual nutrient load were 20.2 g/sq m total nitrogen and 3.8 g/sq m total phosphorus. Unusual water movement patterns and the absence of reducing conditions caused 99% of the total nitrogen load to be discharge, while nearly half of the total phosphorus load was retained in the reservoir. (Geiger-FRC)
W83-00033

LIMNOLOGICAL INVESTIGATIONS OF A MOUNTAIN SPRING POND IN THE SWISS NATIONAL PARK,
Zurich Univ. (Switzerland). Hydrobiological-Limnological Station.
K. Walti, and F. Schanz.
Archiv fur Hydrobiologie, Vol 92, No 1, p 130-136, August, 1981. 2 Fig, 2 Tab, 8 Ref.

Descriptors: *Productivity, *Phytoplankton, *Bacteria, Ponds, Springs, God dal Fuorn Spring, *Switzerland, Primary productivity, Algae, Benthic flora, Photosynthesis, Sulfur bacteria, Seasonal variations, Chemical composition, Water temperature, Water properties, Conductivity, Aquatic productivity, Plankton.

The chemistry and biology of God dal Fuorn spring pond were documented in 1977-79. This pond, undisturbed by human influences, is located at an altitude of 1820 m in the Swiss Alps. The 62 sq m pond with 43 cu m volume has a turnover time of 2 hours. The chemical composition and temperature (6.0-10.5C) were fairly constant throughout the year, suggesting that the water originated deep in the mountain. Nitrogen and total P were extremely low, < 0.1 mg per liter and 0.007-0.50 mg per liter, respectively. Conductivity was 2050-2090 microS per cm; Ca, 540-570 mg per liter; and sulfates, 1420-1470 mg per liter. Bacteria included Desulfovibrio desulfuricans, Beggiatoa alba, Lamprocystis rosea-persicina, Thiocystis violacea, and Chromatium okenii. The planktonic algal population in the open water zone was very low, comprising only a few cells which originated from other habitats (Mougeotia, Spirogyra, Zygnema, and some diatoms). Chara contraria and Chara foetida were the dominant attached algae in the bottom zone. Among the Chara and moss vegetation were found Microspora, Oocystis, Eremosphaera, Cosmarium, Spirogyra, Mougeotia, Microcystis, Nostoc, Chroococcus, and Tribonema. Of the total primary productivity 75-80% originated due to photosynthesis of shore vegetation; 5-10% photosynthesis of plankton; and 5-10% chemosynthesis of sulfur bacteria. (Cassar-FRC)
W83-00034

THE STRUCTURE AND SOME RECENT CHANGES OF THE ZOOBENTHIC COMMUNITY IN THE ERMATINGER BECKEN, A SHALLOW LITTORAL PART OF LAKE CONSTANCE,
Zululand Univ. (South Africa). Dept. of Botany.
P. E. Reavell, and P. Frenzel.
Archiv fur Hydrobiologie, Vol 92, No 1, p 44-52, August, 1981. 3 Fig, 2 Tab, 10 Ref.

Descriptors: *Aquatic plants, *Benthic fauna, *Species composition, Macrophytes, Aquatic habitats, Stagnant water, *Lake Constance, Ermatinger Becken, Littoral zones, Shallow water, Species diversity, Predation, Vegetation effects, Oxygen depletion, Water velocity, *Eutrophication, Water pollution effects, Chara, Potamogeton, Littoral environment, Intertidal areas, Water currents, Aeration, Grasses, *South Africa.

The abundance, distribution, and diversity of zoobenthic species in Ermatinger Becken, Lake Constance, were described. This 4 sq km shallow littoral area is situated at the inflow of the Seerhein from the Obersee (not eutrophic) into the Untersee (naturally eutrophic). Increasing eutrophication was observed from 1948 to 1968 in the littoral zone. The 3 important habitats contained 110 zoobenthic taxa. The emergent reed swamp contained 86 species, 49 of which were restricted to the habitat. The stagnant area contained 22 species, 3 of them restricted; the current-influenced area, 65 species, 23 restricted. Animals were more abundant in regions with higher current velocities and in the winter-dry area in front of the reed swamp. The great species diversity in the reed swamp occurred because the habitat was suitable for ovipositing and overwintering of air breathing Arthropoda on the stems and rhizomes of the vegetation. This region had high organic input from the reed swamp plants and good aeration from the adjacent current. The stagnant area had low species diversity because of occasional oxygen depletion. Faunistic changes since 1948 included disappearance of burrowing mayfly larvae, the amphipod Gammarus pulex, the pulmonate gastropod Lymnaea stagnalis, and triclad turbellarians. These changes were likely a result of alterations in the plant community as a response to increased eutrophication, the disappearance of Chara beds (a necessary habitat structure and protection against predation), and the temporary oxygen deficit caused by a luxuriant Potamogeton growth. (Cassar-FRC)
W83-00036

INVESTIGATIONS ON THE LAKES OF PERU AND THEIR PHYTOPLANKTON. 6 ADDITIONAL CHEMICAL ANALYSES,
Kernforschungsanlage, Juelich (Germany, F.R.). Inst. fuer Biotechnologie III.
E. Hegewald, and K. H. Runkel.
Archiv fur Hydrobiologie, Vol 92, No 1, p 31-43, August, 1981. 3 Fig, 5 Tab, 16 Ref.

Descriptors: *Cations, *Chemical composition, *Phytoplankton, *Lakes, Water quality, *Peru, Saline lakes, Algae, Sodium, Calcium, Magnesium, Dissolved solids, Algal growth.

Water samples of 16 lakes in Peru were collected in 1977 to investigate water quality and phytoplankton concentrations. Total salt concentrations of the water decreased from north to south, inversely with annual precipitation. Paracas and Huacachina, both ponds south of Lima, had about 60,000 mg per liter total dissolved solids. Paracas had no detectable algae; Huacachina had a blue-green algal bloom and a red bacterium, Lamprocystis roseo-persicinum. Two other waters had total dissolved solids of 4749 and 1114 mg per liter. The remainder varied from 55 to 999 mg per liter total dissolved solids. Sodium was the dominant cation in Lake Titicaca, lakes of its drainage area, and coastal desert ponds. Calcium was dominant in most of the lakes. Magnesium was dominant in only 2 lakes, which also had low total dissolved solids levels and no detectable Ca; desmids were the dominant phytoplankton. One lake had no detectable Na. The green alga Monostroma, growing in the River Yanamayo and other rivers and in outdoor fertilized containers, enriched most cations (including heavy metals) from 1000 to 10,000 times. (Cassar-FRC)
W83-00037

METAL BINDING CAPACITY IN RELATION TO HYDROLOGY AND ALGAL PERIODICITY IN TJEUKEMEER, THE NETHERLANDS,
Limnological Inst., Oosterzee (Netherlands). Tjeukemeer Lab.
For primary bibliographic entry see Field 5B.
W83-00039

NITROGEN METABOLISM IN LAKE KIZAKI, JAPAN. III. ACTIVE NITRIFICATION IN EARLY SUMMER,
Nagoya Univ. (Japan). Water Research Inst.
M. Takahashi, T. Yoshioka, and Y. Saijo.
Archiv fur Hydrobiologie, Vol 93, No 3, p 272-286, February, 1982. 5 Fig, 5 Tab, 25 Ref.

Descriptors: *Nitrification, *Bacteria, *Ammonium, *Nitrates, Lakes, Lake Kizaki, *Japan, Nitrites, Bacteria, Hypolimnion, Kinetics, Oxidation,

Water temperature, Dissolved oxygen, Particulate matter, Seasonal variation, Thermal stratification.

Nitrification was active in the hypolimnion (10-20 m depth) of Lake Kizaki, Japan, in late June-early July 1977 and 1979. The oxidation of ammonium began at the 18-20 m depth and moved upwards. The maximum daily increase of nitrate was 1.5 microgram atom per liter per day at 20 m depth, or 7% of total inorganic nitrogen at this depth. No nitrite accumulation was observed. By the middle of July almost all ammonium above 20 m had been oxidized to nitrate. During the nitrification period the potential rates of ammonium and nitrite oxidation increased simultaneously about 2 orders of magnitude over rates in the period of nonactive nitrification, and the potential nitrite oxidation rates were always greater than those of ammonium. The counts of ammonium and nitrite oxidizing bacteria were fairly uniform from May to August. The bacterial number fluctuations did not correspond with the nitrification process, nor did water temperature or dissolved oxygen. Possible reasons for the active nitrification are interaction of nitrifying bacteria with heterotrophic bacteria or particulate matter. (Cassar-FRC)
W83-00040

PHYTOPLANKTON CONTRIBUTION TO ALKALINE PHOSPHATASE ACTIVITY,
Oak Ridge National Lab., TN. Environmental Sciences Div.
A. J. Stewart, and R. G. Wetzel.
Archiv fur Hydrobiologie, Vol 93, No 3, p 265-271, February, 1982. 1 Fig, 2 Tab, 19 Ref.

Descriptors: *Algae, *Bacteria, *Enzymes, Phytoplankton, *Phosphatase, Centrifugation, *Michigan, Filtration, Carbon, Lakes, Lawrence Lake, Lefebre Lake, Little Mill, Gull Lake.

The extent to which the presence of non-algal particulate alkaline phosphatase activity (APA) in water samples may bias estimates of algal APA was examined. APA and assimilated carbon in phytoplankton from 4 Michigan lakes was partitioned by centrifugation. In all cases the assimilated carbon partioned nearly quantitatively (mean partition coefficient value, 8.81 + or - 0.10); APA did not partition quantitatively (partition values, 0.83-5.20 with a mean of 2.53 + or - 0.49). The APA contributions from algae were 5-43%; from nonalgal particulates, 7-73%; and from dissolved enzyme, 14-61%. These results indicate that the quantity of APA directly associated with algal cells may be seriously overestimated by filtration techniqu es. Some of the APA attributed to the dissolved state may actually be affiliated with extremely small free-living bacteria which pass through the filters. (Cassar-FRC)
W83-00041

LITTORAL AND PROFUNDAL MACROINVERTEBRATE COMMUNITIES OF A COASTAL BROWN-WATER LAKE,
Virginia Commonwealth Univ., Richmond. Dept. of Biology.
L. A. Smock, D. L. Stoneburner, and D. R. Lenat.
Archiv fur Hydrobiologie, Vol 92, No 3, p 306-320, October, 1981. 2 Fig, 2 Tab, 21 Ref.

Descriptors: *Invertebrates, Sediments, *Benthic fauna, *Macroinvertebrates, Species composition, Seasonal variation, Lakes, Lake Whitney, *Georgia, *Littoral zone, Water level fluctuations, *Lake sediments.

Lake Whitney, on a barrier island off the Georgia coast, contained 128 macroinvertebrate taxa, as determined over a one-year sampling period. The lake is steep-sided, with two-thirds of its shoreline abutting a Spartina-Juncus marsh. The remaining shoreline consists of sand flats and an active, unvegetated dune ridge. There is no visible surface drainage into or out of the lake, and thus the water level is dependent mainly on fluctuations in precipitation and evaporation-transpiration. Fauna were collected from 3 areas in the acidic, brown water lake. Annual mean densities (in individuals per sq m) were: profundal sediments, 702, with little seasonal variation, dominant species, the chironomid Coelotanypus tricolor; deep littoral macrophyte zone, 4013, dominant species, the amphipod Crangonyx spp.; shallow littoral macrophyte zone, 6519, dominant species, Caenis diminuta; and shallow littoral sediments, 12,256, dominant species Crangonyx spp. The littoral macroinvertebrate densities fluctuated widely during the year, depending on quality and quantity of food resources and changes in water level. (Cassar-FRC)
W83-00044

THE SEDIMENTS OF THE NEW ARTIFICIAL LAKE BOSTALSEE (SAARLAND, GERMANY), WITH PARTICULAR REFERENCE TO MICROBIAL ACTIVITY,
Universitaet des Saarlandes, Saarbruecken (Germany, F.R.). Dept. of Microbiology.
For primary bibliographic entry see Field 5C.
W83-00048

DIEL PERIODICITY IN THE CHEMICAL COMPOSITION OF LAKE PHYTOPLANKTON,
University of Science and Technology, Kumasi (Ghana). Dept. of Biological Sciences.
For primary bibliographic entry see Field 5B.
W83-00049

CHARACTERIZATION OF ACID PHOSPHATASES IN THE ACIDIFIED LAKE GARDSJON, SWEDEN,
Uppsala Univ. (Sweden). Inst. Limnology.
For primary bibliographic entry see Field 5C.
W83-00050

SEASONAL ABUNDANCE OF CERATIUM HIRUNDINELLA, (O.F. MULLER) SCHRANK IN LAKES OF DIFFERENT TROPHY,
Alberta Environmental Center, Vegreville.
For primary bibliographic entry see Field 5C.
W83-00052

AN INTEGRATED STUDY ON LITTORAL AND PELAGIC PRIMARY PRODUCTION IN A SOUTHERN AFRICAN COASTAL LAKE,
Department of Scientific and Industrial Research, Taupo (New Zealand). Freshwater Section.
For primary bibliographic entry see Field 5C.
W83-00053

THE DEVELOPMENT OF ATTENUANCE DEPTH-PROFILING TO FOLLOW THE CHANGING DISTRIBUTION OF PHYTOPLANKTON AND OTHER PARTICULATE MATERIAL IN A PRODUCTIVE ENGLISH LAKE,
Freshwater Biological Association, Ambleside (England).
For primary bibliographic entry see Field 5C.
W83-00055

SPECIES COMPOSITION AND DISTRIBUTION OF ZOOPLANKTON IN A TROPICAL LAKE, LAKE NAIVASHA, KENYA,
Nairobi Univ. (Kenya). Dept. of Zoology.
For primary bibliographic entry see Field 5B.
W83-00056

IN SITU RESPONSE OF PHYTOPLANKTON FLUORESCENCE TO RAPID VARIATIONS IN LIGHT,
Institute of Ocean Sciences, Sidney (Australia).
For primary bibliographic entry see Field 5C.
W83-00141

DYNAMICS OF PHYTOPLANKTON IN FINNISH LAKES,
Maj and Tor Nessling Foundation, Helsinki (Finland).
For primary bibliographic entry see Field 5C.
W83-00153

THE AEROBIC MINERALIZATION OF AMINO ACIDS IN THE SALINE LAKE GREVELINGEN AND THE FRESHWATER HARINGVLIET BASIN (THE NETHERLANDS),
Delta Inst. for Hydrobiological Research, Yerseke (Netherlands).
For primary bibliographic entry see Field 5C.
W83-00178

EXCRETION AND DOC UTILIZATION BY OSCILLATORIA RUBESCENS D.C. AND ITS ACCOMPANYING MICRO-ORGANISMS,
Bundesgesundheitsamt, Neuherberg (Germany, F.R.). Inst. fuer Strahleni hygiene.
For primary bibliographic entry see Field 5C.
W83-00183

COMPONENTS CONTRIBUTING TO LIGHT EXTINCTION IN NATURAL WATER: METHOD OF ISOLATION,
Southern Illinois Univ. at Carbondale. Dept of Botany.
For primary bibliographic entry see Field 5A.
W83-00213

PALEOLIMNOLOGY OF LAKE ISLE, ALBERTA, CANADA (INCLUDING SEDIMENT CHEMISTRY, PIGMENTS AND DIATOM STRATIGRAPHY),
Alberta Univ., Edmonton. Dept. of Botany.
M. Hickman, and D. M. Klarer.
Archiv fur Hydrobiologie, Vol 91, No 4, p 490-508, July, 1981. 14 Fig, 2 Tab, 37 Ref.

Descriptors: *Paleolimnology, *Lake sediments, *Species composition, Sedimentology, Diatoms, Plankton, Paleoclimatology, Stratification, Benthic fauna, Minerals, Calcium, Iron, Eutrophic lakes, Species diversity, Carbonates, Eutrophication, Stratigraphy, Productivity, Volcanoes, *Alberta, Canada, Lake Isle.

The paleolimnology of Lake Isle, a shallow eutrophic lake typical of central Alberta, Canada, was studied through examination of a sediment core, using chemistry, pigments and diatom stratigraphy. Calcium, iron, and carbonate fluctuations revealed that during the warm, dry hypsithermal stage, the lake became more shallow. During this period, the lake was the most productive, displaying diatom stratigraphy. Initially, benthic species (mainly Fragilaria spp.) dominated but were quickly replaced by planktonic species (Stephanodiscus hantzschii, S. astraea, Cyclotella comta and Tabellaria fenestrata). After the volcanic ash from Mount Mazama disrupted the natural aging process, the benthic species again predominated (epipelic species). During the post-hypsithermal period, little change was noted. (Geiger-FRC)
W83-00316

STRATIGAPHIC DIATOM AND CHEMICAL EVIDENCE FOR ACID STRIP-MINE LAKE RECOVERY,
Kent State Univ., OH. Dept. of Biological Sciences.
S. C. Fritz, and R. E. Carlson.
Water, Air, and Soil Pollution, Vol 17, No 2, p 151-163, 1982. 7 Fig, 28 Ref.

Descriptors: *Acid mine drainage, *Lake restoration, Diatoms, Lake sediments, Sediment-water interfaces, Chemical properties, Chemical composition, Population dynamics, *Ohio.

Although much is known about the ecological problems associated with the pollution of surface waters by acid mine drainage and other types of acidic inputs, little is known about the recovery pattern of acidified systems. Paleolimnological techniques were used to study the development of a 60-year-old acid strip mine lake in southern Ohio. These techniques provide a continuous record of changes in both chemical deposition and aspects of the biological community. Stratigraphic analyses of chemical compounds in a sediment core from the lake indicate that chemical recovery of the lake, defined as the rise and maintenance of water pH at values above 4.5, is a discrete process marked in the core by a sharp rise in the sediment concentrations of metals. Stratigraphic analyses of

diatoms in the sediment core suggest that biological recovery may occur in stages, beginning at the sediment-water interface. An early period in which the diatom community was composed of very few species and was dominated by a single acidophilous species was followed by an expansion of the benthic flora and a gradual colonization by many planktonic, epiphytic, and benthic species of primarily alkaliphilous preference. The diatom data indicate that biological development is directly correlated with the apparent shift in pH in terms of the total number of diatom individuals per cubic centimeter and of an increase in the percent of planktonic individuals. However, this biological recovery is not contingent upon complete chemical recovery. (Carroll-FRC)
W83-00329

NITROGEN METABOLISM IN LAKE KIZAKI, JAPAN I. AMMONIUM AND NITRATE UPTAKE BY PHYTOPLANKTON,
Nagoya Univ. (Japan). Water Research Inst.
M. Takahashi, and Y. Saijo.
Archiv fur Hydrobiologie, Vol 91, No 4, p 393-407, July, 1981. 6 Fig, 29 Ref.

Descriptors: *Phytoplankton, *Mesotrophic lakes, *Nitrates, *Ammonium, *Absorption, Mesotrophy, Nitrogen, Irradiation, Water temperature, Euphotic zone, Tracers, Light penetration, Light intensity, Seasonal variation, *Japan, *Lake Kizaki.

The ammonium and nitrate uptake rates of phytoplankton in the small mesotropic Japanese lake, Lake Kizaki, were measured fourteen times from April to October of 1977 by the nitrogen 15 technique. Lake Kizaki is a mesotrophic lake in central Japan with a surface area of 1.4 sq km and maximum depth of 29 m. A thermocline was established from 7 to 11 m depth in early May, and persisted until the end of autumn. Nitrogen uptake experiments were carried out at the same station almost every two weeks. Nitrate uptake was predominant during spring to early summer, while ammonium uptake was more prevalent during mid-summer to autumn. At high light levels in the presence of ammonium, even at concentrations as low as 0.5 micrograms/liter, nitrate uptake was repressed. Phytoplankton displayed a preference for ammonium uptake throughout the study period. In the lower portion of the euphotic zone, nitrogen uptake was affected more by irradiance than by ammonium concentration or water temperature. (Geiger-FRC)
W83-00344

NITROGEN METABOLISM IN LAKE KIZAKI, JAPAN II. DISTRIBUTION AND DECOMPOSITION OF ORGANIC NITROGEN,
Nagoya Univ. (Japan). Water Research Inst.
M. Takahashi, and Y. Saijo.
Archiv fur Hydrobiologie, Vol 92, No 3, p 359-376, October, 1981. 7 Fig, 3 Tab, 31 Ref.

Descriptors: *Nitrogen compounds, *Particulate matter, *Decomposition, Organic nitrogen, *Lake Kizaki, *Japan, Lakes, Organic matter, Nitrates, Seasonal variation, Vertical distribution, Hypolimnion, Thermal stratification.

Seasonal variations in particulate organic nitrogen (PON) and dissolved organic nitrogen (DON) were measured biweekly from April to October 1977 in Lake Kizaki, Japan. On April 5 the vertical distributions of PON and DON were uniform, 3.8 and 4.8 microgram-atom N per liter, respectively. After thermal stratification PON and DON in the trophogenic layer (5-8 m, depending on season) increased to a maximum and then decreased. The maxima were 17.5 microgram-atom N per liter PON in July and 12.4 microgram-atom N per liter DON in August. In midsummer PON reached a maximum of 30 microgram-atom N per liter at a depth of 5 m. Below 10 m average concentrations of PON and DON were uniform with depth and time from July to October, 1.7 at 3.8 microgram atom N per liter, respectively. A one-dimensional diffusion-advection model applied to PON showed that the in situ rate of PON decomposition in the metalimnion was first-order, with a rate constant of 0.086 per day in the 6-8 m deep layer from July 13 to August 9. A one box model determined that the ratio of nitrate production (decomposition rate of organic N) in the hypolimnion (10-20 m depth) was 0.064 microgram-atom N per liter per day. The decrease in organic nitrogen corresponding to the increase of nitrate was not found in the distribution of PON or DON. Results suggested that the source of decomposition in the metalimnion was distributed particulate organic matter, whereas in the hypolimnion it was the sediment trap flux of particulate organic matter. (Cassar-FRC)
W83-00345

2I. Water In Plants

SEASONAL PROGRESSIONS IN THE WATER RELATIONS OF DECIDUOUS AND EVERGREEN PERENNIALS IN THE NORTHERN CALIFORNIA CHAPARRAL,
California Univ., Davis. Dept. of Botany.
H. W. Calkin, and R. W. Pearcy.
In: Proceedings of the Symposium on Dynamics and Management of Mediterranean-Type Ecosystems, June 22-26, 1981, San Diego, California, Pacific Southwest Forest and Range Experiment Station General Technical Report PSW-58, 1982. p 591, 1 Tab, 1 Fig, 2 Ref.

Descriptors: *Chaparral, *Plant water potentials, *Osmotic pressure, *Stomatal transpiration, Seasonal variation, Adaptation, Diurnal distribution, Leaves, Turgidity, *California.

A pressure bomb and null balance diffusion porometer were used to follow the seasonal progression of osmotic adjustment and stomatal reactivity in the following chaparral perennials in the Vaca hills of northern California: toyon (Heteromeles arbutifolia), redbud (Cercis occidentalis), and buckeye (Aesculus californica). In general, as the dry season progressed, stomatal opening became more restricted to morning hours, and the magnitudes of the morning peak and mid-day plateau decreased. Leaf water potentials became more negative and for Heteromeles and Cercis reached values near their turgor loss point. Aesculus leaves maintained turgor pressures of at least .5 MPa all season. The seasonal drop in osmotic potentials and plant water potentials was greatest in Heteromeles, intermediate in Cercis and least in Aesculus. In Heteromeles and Cercis both stomatal and osmotic adjustments contribute to the buffering of cell volume and turgor. Osmotic adjustment played the role in Aesculus. (Moore-SRC)
W83-00307

2J. Erosion and Sedimentation

RELATION OF USLE FACTORS TO EROSION ON RANGELAND,
Purdue Univ., Lafayette, IN. Dept. of Agricultural Engineering.
G. R. Foster.
In: Proceedings of the Workshop on Estimating Erosion and Sediment Yield on Rangelands, Tucson, Arizona, March 7-9, 1981, Agricultural Reviews and Manuals ARM-W-26, June 1982, p 17-35, 3 Fig, 2 Tab, 31 Ref.

Descriptors: *Rangeland, *Soil erosion, *Runoff, *Erosion control, Climate, Soil properties, Topography, Land use, Rainfall, Slopes, Soil conservation, Range management.

Factors in the Universal Soil-Loss Equation (USLE) are measures of the effect of climate, soil, topography, and land use on erosion. The factors are referenced to a unit plot, 72.6 ft long on 9% slope, maintained in tilled, continuous fallow. The USLE is primarily used to inventory erosion under current conditions and to guide the selection of practices to control erosion to a tolerable level. It has been widely applied to cropland in the Eastern U.S. and recently has been extended to Western rangeland. Special considerations are required in this new application because rangeland conditions differ significantly from those used to derive the USLE. The USLE factors are A= R K L S C P, where A= soil loss, R= rainfall-runoff erosivity factor, K= soil erodibility factor, L= slope length factor, S= slope steepness factor, C= cover and management factor, and P= supporting conservation practice factor. The infrequency of rainfall and its great spatial variability in the West are considerations in application of the USLE. Many rangeland slopes exceed 20% or 25%, the upper limit of the data used to develop the S factor. Using present equations for S, the soil loss from steep slopes may be over-estimated. The C factor is often the most important factor. At the site, it is the only factor that a range manager may easily change to control erosion. (Moore-SRC)
W83-00096

USE OF EROSION MODELS ON WESTERN RANGELANDS,
Bureau of Land Management, Boise, ID.
K. A. Gebhardt.
In: Proceedings of the Workshop on Estimating Erosion and Sediment Yield on Rangelands, Tucson, Arizona, March 7-9, 1981, Agricultural Reviews and Manuals ARM-W-26, June 1982, p 39-46, 1 Fig, 3 Tab, 11 Ref.

Descriptors: *Soil erosion, *Rangeland, *Grazing, *Mathematical models, Vegetation, Environmental Impact Statement, Range management, Sediment yield, Resources management.

Soil loss and sediment yield equations have received greater use on western rangelands in recent years largely becuase of the emphasis on quantitative impact analysis. The available soil loss equations have been used in many grazing Environmental Impact Statements (EIS) to estimate existing soil loss and to predict soil loss due to changes in vegetative cover, but managers may place too much validity on the estimates when the differences are too small to be considered significant. Limitations of the soil loss estimates should be explained to avoid misuse in application. Universal Soil Loss Equation (USLE) estimates are generally most accurate with slope lengths of less than 400 ft and slopes from 3 to 18% having consistent cropping and management systems. Since the USLE is empirically derived, these limitations do not favor wide application to rangeland without extensive field validation. Rangeland limitations of soil loss equations can be quite extensive. Application of available erosion methodologies must be geared toward solving problems associated with resource use. The erosion model must be designed for the needed application and be sensitive to changes in manageable characteristics (those which can be affected by management actions). (Moore-SRC)
W83-00097

THE USLE RAINFALL FACTOR FOR SOUTHWESTERN U. S. RANGELANDS,
Science and Education Administration, Tucson, AZ. Southwest Rangeland Watershed Research Center.
For primary bibliographic entry see Field 4D.
W83-00098

EFFECTS OF SLOPE LENGTH AND STEEPNESS ON SOIL EROSION FROM RANGELANDS,
Washington State Univ., Pullman.
D. K. McCool.
In: Proceedings of the Workshop on Estimating Erosion and Sediment Yield on Rangelands, Tucson, Arizona, March 7-9, 1981, Agricultural Reviews and Manuals ARM-W-26, June 1982, p 73-95, 1 Fig, 1 Tab, 34 Ref.

Descriptors: *Slopes, *Rangeland, *Soil erosion, *Rainfall rate, *Runoff, Mathematical models, Rill erosion, Rainfall simulators.

Data on the effect of slope length and steepness on soil loss from rangelands are virtually nonexistent. If accurate predictions of soil loss from rangelands are needed for range resource maintenance or water quality purposes, a program of data collection will be needed. The most rapid means of collecting this data will be with rainfall simulators larger than those previously used. In the interim, it is suggested that rangelands be classified as Category I (no observed or expected rill erosion under

large rates and volumes of rainfall and runoff), Category II (moderate rainfall and runoff rate and moderate rilling observed or expected), and Category III (rill erosion expected from high rainfall and runoff rates). Equations were developed for predicting the influence of slope length and steepness on erosion. Because there is little data to support the relationships in these equations, and because of the wide range of values for slope steepness factor at slopes above 20% calculated from them, the equations are offered for field use on a trial basis and to elict response from resource management personnel and researchers. (Moore-SRC)
W83-00099

SPECIAL PROBLEMS IN THE APPLICATION OF THE USLE TO RANGELANDS: C AND P FACTORS,
Purdue Univ., Lafayette, IN. Dept. of Agricultural Engineering.
G. R. Foster.
In: Proceedings of the Workshop on Estimating Erosion and Sediment Yield on Rangelands, Tucson, Arizona, March 7-9, 1981, Agricultural Reviews and Manuals ARM-W-26, June 1982, p 96-100, 4 Ref.

Descriptors: *Rangelands, *Soil erosion, *Mathematical models, *Range management, Runoff, Land management, Vegetation.

The Universal Soil Loss Equation (USLE) is being used to estimate erosion on rangeland in the Western United States. This is a new application of the USLE, and values for the cover-management factor C and the supporting practices factor P are being used that were derived from data principally obtained from Eastern U. S. cropland soils and covers. Consequently, research is needed to validate the currently used C and P values and to develop new values where necessary. Development of C and P values for Western rangeland will need to include identification of the influencial factors affecting erosion on rangeland, and evaluation of the effects of erosion pavement, cover, nonuniformity of cover, roughness, soil disturbance, roots, freezing and thawing, burning, infrequent and intense storms, and ridges, pitting and other mechanical treatments on runoff and erosion. (Author's abstract)
W83-00100

A TEST OF THE USLE ON BARE AND SAGEBRUSH PLOTS IN UTAH,
Utah State Univ., Logan. Watershed Science Unit.
For primary bibliographic entry see Field 4D.
W83-00101

USE OF RAINFALL SIMULATORS TO DETERMINE PARAMETERS FOR EROSION PREDICTION,
Science and Education Administration, Ames, IA.
J. M. Laflen.
In: Proceedings of the Workshop on Estimating Erosion and Sediment Yield on Rangelands, Tucson, Arizona, March 7-9, 1981, Agricultural Reviews and Manuals ARM-W-26, June 1982, p 106-114, 36 Ref.

Descriptors: *Rainfall simulators, *Soil erosion, *Agriculture, *Model studies, Storms, Rainfall intensity, Mathematical models, Runoff.

Rainfall simulators are necessary to determine Universal Soil Loss Equation (USLE) parameters because of rapid changes in agricultural practices. The rainfall simulator has been used extensively to collect soil erodibility data. Plot preparation in nearly all studies has consisted of removing vegetation and tillage. Rainfall simulator storms have been similar, but storm sequences have varied somewhat. The rainfall simulator has also been used extensively to study the effect of cropping and tillage on soil erosion. A large number of the studies have been performed by using a common storm arrangement of a 60-minute storm, followed about 24 hours later by two 30-minute storms separated by a 15-minute period, all at an intensity of 6.4 cm/hr. Cropping management factors have not been directly computed from rainfall simulation results. Values are generally relative to a treatment having a known c-value. Studies should be designed and conducted to gain data for mathematical models describing the erosion process. Length simulation during rainfall simulation has been found to be highly useful. (Moore-SRC)
W83-00102

ESTIMATING SEDIMENT YIELD FROM RANGELAND WITH CREAMS,
Purdue Univ., Lafayette, IN. Dept. of Agricultural Engineering.
G. R. Foster, and L. J. Lane.
In: Proceedings of the Workshop on Estimating Erosion and Sediment Yield on Rangelands, Tucson, Arizona, March 7-9, 1981, Agricultural Reviews and Manuals ARM-W-26, June 1982, p 115-119, 14 Ref.

Descriptors: *Rangelands, *CREAMS, *Soil erosion, *Sediment yield, *Mathematical models, Slopes, Deposition, Backwater, Sediment transport, Storms, Rainfall-runoff relationships, Agriculture.

The erosion/sediment yield component of CREAMS, a field-scale model for Chemicals, Runoff, and Erosion from Agricultural Management Systems, may be used to estimate sediment yield from small rangeland watersheds. The component operates on a storm-by-storm basis using rainfall erosivity, runoff volume, and a characteristic runoff rate. The erosion/sediment yield component of CREAMS was originally developed for agricultural fields but has sufficient generality to apply to rangelands, disturbed forest areas, construction sites, and surface mines. The component also applies to a broad range of conservation practices including conservation tillage, rotations, contouring, strip-cropping, terraces, grassed waterways, and small impoundments. It considers the influence of topographic features on erosion and deposition along concave, convex, and complex slopes; deposition by backwater at field outlets; and erosion and deposition in natural and constructed waterways. The model has overland flow, concentrated flow, and impoundment components to represent the major hydrologic, hydraulic, erosion, deposition, and sediment transport processes on field-sized areas. Validation studies have shown that the model gives reasonable results for agricultural areas with little or no calibration. (Moore-SRC)
W83-00103

MODELING EROSION IN OVERLAND FLOW,
Science and Education Administration, Tucson, AZ. Southwest Rangeland Watershed Research Center.
For primary bibliographic entry see Field 4D.
W83-00104

SEDIMENT YIELD FROM SMALL SEMIARID RANGELAND WATERSHEDS,
Science and Education Administration, Tucson, AZ.
For primary bibliographic entry see Field 4D.
W83-00105

PREDICTING SEDIMENT YIELDS FROM SAGEBRUSH RANGELANDS,
Science and Education Administration, Boise, ID. Northwest Watershed Research Center.
For primary bibliographic entry see Field 4D.
W83-00106

TESTING THE MODIFIED UNIVERSAL SOIL LOSS EQUATION,
Agricultural Research Service, Temple, TX.
For primary bibliographic entry see Field 4D.
W83-00107

DEVELOPING A USLE COVER-MANAGEMENT (C) FACTOR PROCEDURE FOR FOREST CONDITIONS,
Forest Service, Atlanta, GA.
For primary bibliographic entry see Field 4D.
W83-00108

THE SPATIAL DISTRIBUTION IN SOUTHERN AFRICA OF RAINFALL EROSIVITY FOR USE IN THE UNIVERSAL SOIL LOSS EQUATION,
Department of Agriculture and Fisheries, Pietermaritzburg (South Africa).
A. A. Smithen, and R. E. Schulze.
Water SA, Vol 8, No 2, p 74-78, April, 1982. 3 Fig, 1 Tab, 9 Ref.

Descriptors: *Erosion rates, *Rainfall inensity, *Kinetic energy, *Soil erosion, *South Africa, Universal Soil Loss Equation, Spatial distribution, Distribution.

Rainfall erosivity parameters are essential in soil loss modeling. Rainfall erosivity is a climatic factor which can only be determined from local rainfall data. The rainfall erosivity factor, EI30, a factor used in the Universal Soil Loss Equation (USLE), is the product of the kinetic energy of falling rain (E) and its maximum 30 min intensity (I30). Design values of EI30 for South Africa are derived from 4 parameters based on daily rainfall values: total rainfall, effective rainfall, modified Fournier's index, and burst factor. The estimated long-term average annual EI30 values are plotted on a map and lines of equal rainfall erosivity drawn. This permits estimating the EI30 for any location in South Africa and the R factor of the USLE. Another map shows annual values of rainfall erosivity for a 25-year return period. (Cassar-FRC)
W83-00140

EROSION AND SEDIMENTATION AS PART OF THE NATURAL SYSTEM,
California State Univ., Northridge. Dept. of Geography.
R. B. Howard.
In: Proceedings of the Symposium on Dynamics and Management of Mediterranean-Type Ecosystems, June 22-26, 1981, San Diego, California, Pacific Southwest Forest and Range Experiment Station General Technical Report PSW-58, 1982. p 403-408, 28 Ref.

Descriptors: *Chaparral, *Soil erosion, *Sedimentation rates, *Precipitation, *California, Runoff, Fires, Climate, Orographic precipitation, Water repellent soils, Slopes, Seasonal distribution.

There are two basic classes of processes responsible for earth surface morphology: endogenic and exogenic processes. The exogenic processes are controlled largely by atmospheric agencies, and can be divided into denudation and deposition. Denudation involves both weathering as well as erosion. In southern California the denudational environments coincide with the bedrock of the mountain fronts; this also tends to be the environment of the chaparral. Climatically, the chaparral environment displays a strongly seasonal precipitation pattern which is characteristic of the Mediterranean climate. Superimposed on this seasonal regime is the orographic influence on the spatial distribution of precipitation. Given the physical conditions of California's chaparral watersheds, it is surprising that they do not yield an even greater amount of sediment under normal conditions. Fire is also a major environmental agent in shaping California's chaparral. After fire, runoff and sediment yield increase well above normal. This is probably due in part to the development of a hydrophobic layer below the soil's surface. In the chaparral environment of Southern California with its tectonically active mountain masses, high relief, steep slopes and strongly seasonal precipitation, large normal sediment yields are to be expected. Increased sediment yields of up to 30 times normal are also natural in this environment because of fire, approaching thresholds and the variable, seasonal precipitation. (Moore-SRC)
W83-00305

2K. Chemical Processes

SELECTED HYDROGEOLOGIC DATA FROM SOUTHERN SWEET GRASS COUNTY, SOUTH-CENTRAL MONTANA,
Geological Survey, Helena, MT. Water Resources Div.
For primary bibliographic entry see Field 7C.
W83-00076

CHEMICAL AND ISOTOPIC COMPOSITION OF WATER FROM THERMAL AND MINERAL SPRINGS OF WASHINGTON,
Geological Survey, Menlo Park, CA. Water Resources Div.
R. H. Mariner, T. S. Presser, and W. C. Evans.
Available from the OFSS, USGS Box 25425, Fed. Ctr. Denver, CO. 80225, Price: $2.50 in paper copy, $3.50 in microfiche. Open-File Report 82-98, February 1982, 18 p, 2 Fig, 5 Tab, 26 Ref.

Descriptors: *Chemical analysis, *Stable isotopes, *Thermal springs, *Mineral springs, Thermal water, Geothermal studies, Chemical composition, Sampling, *Washington, Geothermometry.

Water from thermal springs of Washington range in chemical composition from dilute NaHC03, to moderately saline C02-charged NaHC03-Cl waters. St. Martin's Hot Spring which discharges a slightly saline NaCl water, is the notable exception. Mineral springs generally discharge a moderately saline C02-charged NaHC03-Cl water. The dilute Na-HC03 waters are generally associated with granite. The warm to hot waters charged with C02 issue on or near the large stratovolcanoes and many of the mineral springs also occur near the large volcanoes. The dilute waters have oxygen isotopic compositions which indicate relatively little water-rock exchange. The C02-charged waters are usually more enriched in oxygen-18 due to more extensive water-rock reaction. Carbon-13 in the C02-charged thermal waters is more depleted (-10 to -12 permil) than in the cold C02-charged soda springs (-2 to -8 permil) which are also scattered throughout the Cascades. The hot and cold C02-charged waters are supersaturated with respect to CaC03, but only the hot springs are actively depositing CaC03. Baker, Gamma, Sulphur, and Ohanapecosh seem to be associated with thermal aquifers of more than 100C. (USGS)
W83-00112

WATER-QUALITY CHARACTERISTICS OF SIX SMALL, SEMIARID WATERSHEDS IN THE GREEN RIVER COAL REGION OF COLORADO,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 5A.
W83-00124

A STUDY OF TRENDS IN TOTAL PHOSPHORUS MEASUREMENTS AT NASQAN STATIONS,
Geological Survey, Reston, VA. Water Resources Div.
For primary bibliographic entry see Field 5B.
W83-00126

METHODS FOR COLLECTION AND ANALYSIS OF GEOPRESSURED GEOTHERMAL AND OIL FIELD WATERS,
Geological Survey, Menlo Park, CA. Water Resources Div.
M. S. Lico, Y. K. Kharaka, W. W. Carothers, and V. A. Wright.
Available from Supt. of Documents, GPO, Washington, DC 20402, Price, $3.50. Water-Supply Paper 2194, 1982. 21 p, 2 Fig, 22 Ref.

Descriptors: *Geothermal studies, *Thermal water, *Oil fields, *Chemical analysis, Geochemistry, Oil wells, Water sampling, Water analysis, Connate water, Brines, Geopressured.

Present methods are described for the collection, preservation, and chemical analysis of waters produced from geopressured geothermal and petroleum wells. Detailed procedures for collection include precautions and equipment necessary to insure that the sample is representative of the water produced. Procedures for sample preservation include filtration, acidification, dilution for silica, methyl isobutyl ketone (MIBK) extraction of aluminum, addition of potassium permanganate to preserve mercury, and precipitation of carbonate species as strontium carbonate for stable carbon isotopes and total dissolved carbonate analysis. Chemical parameters determined at the well site are sulfide, alkalinity, Ph, ammonia, and conductivity. Laboratory procedures are given for the analysis of lithium, sodium, potassium, rubidium, cesium, magnesium, calcium, strontium, barium, iron, manganese, zinc, lead, aluminum, and mercury by atomic absorption and flame emission spectroscopy. Chloride is determined by silver nitrate titration and fluoride by ion-specific electrode. Bromide and iodide concentrations are determined by the hypochlorite oxidation method. Sulfate is analyzed by titration using barium chloride with thorin indicator after pretreatment with alumina. Boron and silica are determined colorimetrically by the carmine and molybdate-blue methods, respectively. Aliphatic acid anions (acetic through valeric) are determined by gas chromatography after separation and concentration in a chloroform-butanol mixture. (USGS)
W83-00127

THE CHEMISTRY AND PHYTOPLANKTON OF THE ORINOCO AND CARONI RIVERS, VENEZUELA,
Colorado Univ., Boulder. Dept. of Environmental, Population and Organismic.
For primary bibliographic entry see Field 5B.
W83-00187

THE CHEMICAL COMPOSITION OF WATER AND THE ANALYTICAL CHEMIST: A CHALLENGE,
Hydrological Research Inst., Pretoria (South Africa).
For primary bibliographic entry see Field 5A.
W83-00290

SEASONAL MASS BALANCE OF MAJOR IONS IN THREE SMALL WATERSHEDS IN A MARITIME ENVIRONMENT,
Dalhousie Univ., Halifax. Dept. of Biology.
J. G. Ogden, III.
Water, Air, and Soil Pollution, Vol 17, No 2, p 119-130, 1982. 3 Fig, 5 Tab, 7 Ref.

Descriptors: *Chemistry of precipitation, *Ions, Watersheds, Marine climates, Seasonal variation, Small watersheds, Sodium, Potassium, Calcium, Magnesium, Chlorides, Sulfates, Conductivity, Alkalinity, Hydrogen ion concentration, *Nova Scotia.

Precipitation and outlet stream water samples from three small watersheds in central Nova Scotia, Canada, were monitoried at approximately month ly intervals from May 1977 to November 1978 for major ion chemistry. The watersheds, which ranged from 16.4 to 544 hectares in area, were located at distances of 0.5, 20, and 40 kilometers from the Atlantic coast. A total of 180 precipitation and 55 outlet str eam flow samples were analyzed for sodium, potassium, calcium, magnesium, chloride, sulfate, phosphate, nitrate, bicarbonate alkalinity, pH, and conductivity. The results were compared to similar studies at Hubbard Brook, New Hampshire, and at Kejimkujik National Park, Nova Scotia. The proximity to Atlantic Ocean and Bay of Fundy coastal sources of marine aerosols was reflected in the major ion chemistry. The bulk of the deposition of marine ions occurred within 20 kilometers of the coast, although the most inland of the Nova Scotia stations (Kejimkujik and Kerr Lake) showed between 4 and 7 times the concentrations of marine ions as Hubbard Brook. Seasonal mass balances showed that more than 50% of the hydrogen ions in precipitation are retained in the watersheds (except for the Fink Cove ecosystem, which is ombrotrophic), principally at the expense of basic cations being leached from the watersheds. Decreases in the output of both hydrogen ions and sulfate during the summer months appear to be the result of biological reduction to hydrogen sulfide (H2S). Deposition of excess sulfate in Nova Scotia through precipitation is primarily as sulfuric acid, rather than as the ammonium sulfate characteristic of continental precipitation. (Carroll-FRC)
W83-00323

STRATIGAPHIC DIATOM AND CHEMICAL EVIDENCE FOR ACID STRIP-MINE LAKE RECOVERY,
Kent State Univ., OH. Dept. of Biological Sciences.
For primary bibliographic entry see Field 2H.
W83-00329

2L. Estuaries

SEASONAL VARIATION OF ZOOPLANKTON OF THE VELI LAKE, SOUTH-WEST COAST OF INDIA,
Kerala Univ., Trivandrum (India). Dept. of Aquatic Biology and Fisheries.
For primary bibliographic entry see Field 2H.
W83-00027

SOME NOTES ON THE ECOLOGY OF AQUATIC OLIGOCHAETES IN THE DELTA REGION OF THE NETHERLANDS,
Provincial Water Authority, Zwolle (Netherlands). Dept. of Watershed Management.
P. F. M. Verdonschot.
Archiv fur Hydrobiologie, Vol 92, No 1, p 53-70, August, 1981. 6 Fig, 1 Tab, 34 Ref.

Descriptors: *Oligochaetes, *Ecological effects, *Sediments, Worms, Species distribution, Invertebrates, *The Netherlands, Haringvliet-Hollands Diep, Aquatic habitats, Organic matter, Salinity, Benthic fauna, Tubifex, Peloscolex, Limnodrilus, Deltas, Shallow water, Water resources development.

Examination of aquatic oligochaetes collected during 1959-70 in the tidal channel sediments of the Delta area of the Netherlands revealed 2 distinct groups, mesohaline-marine and euryhaline-limnetic. Peloscolex benedeni was the most abundant species in the mesohaline-marine group. Chlorinity tolerances for each species were listed. Substrate affected distribution of some oligochaetes, P. benedeni thriving in anoxic sediments; Limnodrilus hoffmeisteri in well sorted muddy sand; Limnodrilus udekemianus in well sorted clay. Several species including Tubifex showed no preference for a particular substrate. Distribution with respect to organic content of the sediment was not clearly demonstrated. Distribution according to depth was seen only in Tubifex costatus, which was limited to shallow regions. When structures separated the Haringvliet-Hollands Diep from the North Sea in 1970, Tubifex development increased for 2 years due to the high organic content of the sediments. Chironomids and the oligochaete predator, Procladius spp, also increased. During 1971-77 species composition of the oligochaete fauna changed little, and several tubificid species shared the same habitat. The coexistence was possible because different species selectively removed various components (specific groups of bacteria or diatoms) from the organic sediments. (Cassar-FRC)
W83-00035

HEAVY METALS IN OYSTERS AND CLAMS OF ST. LOUIS BAY, MISSISSIPPI,
Gulf Coast Research Lab., Ocean Springs, MS. Dept. of Analytical Chemistry.
For primary bibliographic entry see Field 5C.
W83-00159

ANOXIC NUTRIENT REGENERATION AND THE EUTROPHICATION OF ESTUARINE WATERS,
Rhode Island Univ., Kingston. School of Oceanography.

For primary bibliographic entry see Field 5C.
W83-00263

3. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

DEVELOPMENT OF NEW CHEMICAL ADDITIVES AND TREATMENTS FOR SCALE CONTROL IN SALINE WATER EVAPORATORS,
Battelle Columbus Lab., OH.
J. F. Miller, J. L. Means, A. E. Austin, and J. A. Eibling.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-108308, Price codes: A05 in paper copy, A01 in microfiche. Final Report, January, 1982. 68 p, 18 Fig, 16 Tab, 8 Ref, 1 Append. OWRT C-00160-S (0460)(1).

Descriptors: *Scaling, *Saline water, *Additives, *Evaporators, *Inhibitors, *Desalination, Chemical properties, Chemical reactions, Corrosion, Fouling, Saline water systems, Salinity, Chemical treatment, Seawater, Evaluation, Design criteria, Retardants, Distillation, Distilled water.

Using laboratory procedures which simulated distillation conditions (including the presence of a heat-exchange surface), it was demonstrated that aminophosphonic acid additives in equivalent concentrations of 2-4.5 ppm in input sea water inhibited both alkaline and calcium sulfate scale deposition for extended periods. These periods were believed to be in excess of mean residence times for the brine in distillation systems operated in either once-through or recirculation modes. These periods were in excess of 200 hours and 70 hours at 125 and 142 degrees, respectively, at a concentration factor of 2.25 simulated sea water; and 16-17 hours at a concentration factor of one at 163 degrees on heat-transfer surfaces 13 to 16-plus degrees above this base temperature. Inhibitor costs were estimated at 1-3 cents/1000 gallons of input sea water to inhibit scale formation indefinitely under currently-used conditions,as indicated by the test results. Such use of the inhibitors will make operation under more efficient conditions possible, and would eliminate acid treatment and accompanying corrosion. Pilot-scale testing with the use of these inhibitors is recommended, based upon the success in the simulated study conducted. The inhibitors were hexamethylene-diaminetetra (methylenephosphonic acid) and aminomethylphosphonic acid. (Zielinski-MAXIMA)
W83-00222

HYDRODYNAMICS AND FOULING OF PRESSURE DRIVEN MEMBRANE DESALINATION AND WATER TREATMENT SYSTEMS,
Massachusetts Inst. of Tech., Cambridge. Dept. of Mechanical Engineering.
R. F. Probstein.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-108480, Price codes: A03 in paper copy, A01 in microfiche. Completion Report, March, 1982. 36 p, 15 Fig, 2 Tab, 5 Ref. OWRT C-80301-S(8836)(1), 14-34-001-8536.

Descriptors: *Model studies, *Membrane processes, *Reverse osmosis, *Fouling, *Desalination, Kinetics, Ultrafiltration, Membranes, Membrane filters, Scaling, Corrosion, Permeation, Fluctuations, Hydrodynamics, Fluid mechanics, Mathematical studies, Mathematical models.

A simple kinetic model is developed for rate of growth of a colloidal fouling film in steady unobstructed laminar and turbulent reverse osmosis systems. Experimental results are provided concerning the fouling of cellulose acetate membranes by a colloidal iron hydroxide suspension in saline solution. Data on foulant film thickness and deposition rate were found to be in good agreement with the model, and demonstrated that the characteristic build-up time of the foulant is controlled by foulant and membrane properties. In a second phase of study, an optimization of flow conditions was developed for ultrafiltration (UT) in laminar channel flow systems that minimizes permeate product cost. Permeate flux-applied pressure data were obtained for borrine serum albumin (BSA) solutions with/without detached strip-type promoters, and optimum interpromoter spacing and flow condition values were determined. Further, the limiting flux in unpromoted UT systems was derived for laminar/turbulant flows using a thin-film model which afforded a method for determining gel diffusivity/concentration from solvent limiting flux data. BSA gelation properties were derived from laminar/turbulant channel flow experiments. The low polarization of laminar UT systems was also analyzed, and an integral method solution developed for flux as a function of flow conditions and solvent/solute properties affording good agreement between prediction and UT BSA flux-pressure data. (Zielinski-MAXIMA)
W83-00244

DEVELOPMENT OF CHLORINE RESISTANT MEMBRANES, POLYIMIDE MEMBRANES AND POROUS SUBSTRATES,
Membrane Systems, Inc., San Diego, CA.
M. D. Heisler, M. E. McKee, J. E. Tomaschke, R. L. Fox, and J. D. Opdycke.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-108506, Price codes: A14 in paper copy, A01 in microfiche. Completion Report, December, 1981. 298 p, 92 Fig, 91 Tab, 9 Ref. OWRT C-00051-0(0502)(1), 14-34-0001-0502.

Descriptors: *Membranes, *Reverse osmosis, *Membrane processes, *Chlorination, *Thin films, Desalination, Wastewater treatment, Water treatment, Polymers, Porous media, Synthesis, Engineering, Fabrication, Design criteria.

Concurrent studies were carried out for the development of chlorine-resistant composite membranes, polyinide (PI) membranes, and porous substrates for composite membranes. A synthesized tertiary polyamide (based on poly (oxetane) secondary diamine) was used to develop composite membranes which were evaluated for reverse osmosis (RO) performance on chlorinated feeds. A novel tertiary polyurethane (reaction of piperazine and ethylene bischloroformate) was also synthesized, and tested in composite membrane application using thin film deposition. Further, continuous machine fabrication technology was examined for asymmetric polyimide membranes having competitive RO performance, and PI thin film deposition was studied to form composite membranes. New porous supports were also developed, characterized, an d successfully used in continuous thin film composite membrane formation. Refinements in formulation and fabrication conditions for PI membranes resulting in continuous machine casting in a 1-foot width to give membranes with exceptional transport properties. Control of key variables gave 50-foot long runs of continuous PI membrane with 14-17 GFD flux and 97-98% salt rejection. The results clearly demonstrate the ability to fabricate asymmetric (continuous sheet) PI membrane from commercial polymer and to incorporate this into a standard spiral element configuration. (Zielinski-MAXIMA)
W83-00246

DEVELOPMENT AND DEMONSTRATION OF A REVERSE-OSMOSIS ENERGY-RECOVERY DEVICE,
SRI International, Menlo Park, CA.
G. B. Andeen, and J. C. Eid.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-108605, Price codes: A03 in paper copy, A01 in microfiche. Final Report, June, 1982. 37 p, 16 Fig, 2 Tab, 4 Ref, 1 Append. OWRT C-00146-D(1403)(1), 14-34-0001-1403.

Descriptors: *Reverse osmosis, *Desalination, *Desalination apparatus, *Energy recovery, *Mechanical equipment, Seawater, Desalination plants, Demineralization, Membranes, Membrane processes, Energy, Mechanical engineering, Pumps, Pressure head, Industrial plants.

An energy-recovery device for a seawater reverse-osmosis (RO) system was designed, fabricated, and tested. The device, comprised of a valving system, uses waste streams from an RO system to drive a pump which, in turn, sends additional feed flows to the RO elements. Test data demonstrated that efficiencies exceeding 95% can be expected, and, hence, energy consumption in a seawater RO desalination sys tem can be decreased by 50%. Further, conversion may be decreased from 30% in order that membrane life is extended, and the size of the main pump and prime mover can be reduced by 50%. The device was subjected to almost 1000 hours (175,000 cycles) of testing, simulating its operation in a 4800 gallon/day seawater system, producing an outlet pressure of over 850 lbs/sq-in. for an inlet pressure of 750 lbs/sq-in. The device demonstrated an ability to self-start and to be controlled. An analysis of value and costs suggested that the device would be available to systems as small as 10,000 gallons/day. The results of this work confirm that significant improvements in the energy and economic performance of seawater desalination systems can be achieved. (Zielinski-MAXIMA)
W83-00256

DEVELOPMENT OF NOVEL POROUS SUBSTRATES FOR ULTRAFILTRATION, DESALINATION AND WATER RECLAMATION--PART III,
Gulf South Research Inst., New Orleans, LA.
I. Cabasso, T. C. Shen, B. L. Zimny, and R. J. LeBoeuf.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-108639, Price codes: A06 in paper copy, A01 in microfiche. Final Report, May, 1982. 113 p, 74 Fig, 11 Tab, 9 Ref. OWRT C-00151-D(0523)(1), 14-34-0001-0523.

Descriptors: *Porous media, *Ultrafiltration, *Desalination, *Reclaimed water, *Synthesis, Porosity, Polymers, Electron microscopy, Water treatment, Water quality, Water quality control, Membrane processes, Composite membranes, Water reuse.

The objective of this overall project was to develop novel porous supports which can be used to fabricate composite membranes for desalination and water reclamation by reverse osmosis. Two commercially-available polymers were integrated: poly (phenylene oxide) and ethyl cellulose. The former (PPO), chemically-modified to the desired porous support via common water coagulating techniques, was described previously. The development of the ethyl cellulose (ET) support is currently reported. Several attempts to prepare the asymmetric (salt-rejecting) membrane from ET had limited success, and was discontinued due to inferior performance and particulate contamination in the commercial grade ET polymer. The attractiveness of ET over cellulose acetate resides in its pendent ester linkages (stable over a wide pH range), much lower surface energy and hydrophilicity, and, hence, the fine porous matrix prepared from ET via phase inversion by water coagulation does not collapse on drying. A variety of porous substrates were developed and studied. Further, hollow fibers and composite desalination membranes were prepared; the latter providing information for the preparation of conventional composite membranes using the ET substrate. Membranes developed from commercial ET were macrovoid-free, having a morphology corresponding to the ultimate structure needed from such porous supports. Membrane morphologies were studied using scanning electron microscopy. (Zielinski-MAXIMA)
W83-00259

A STUDY OF GLOW DISCHARGE POLYMERIZATION AS A MEANS OF PREPARING COMPOSITE REVERSE OSMOSIS MEMBRANES WITH ULTRATHIN SKIN,
Missouri Univ.-Rolla. Dept. of Chemical Engineering.
H. Yasuda.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-107995, Price codes: A05 in paper copy, A01 in microfiche. Final Report, January, 1982. 80 p, 32 Fig, 7 Tab,

15 Ref, 3 Append. OWRT C-80131-S(8525)(1), 14-34-0001-8525.

Descriptors: *Reverse osmosis, *Membranes, *Synthesis, *Membrane processes, *Thin films, Polymers, Design criteria, Desalination Water treatment, Porous media, Engineering, Fabrication, Process control.

Polymer thin film formation by glow discharge in organic vapors (glow discharge polymerization, or plasma polymerization (PP) from a monomer (3.g., styrene) produces polymers which are considerably different from those formed from the same monomer by conventional polymerization. Such plama polymers form highly branched and crosslinked networks, excellent adhesion of a thin deposit to the substrat e in glow discharge from low pressure plasma, are completely amorphous, and without macroscopic pinholes. Hence, an ideal composite reverse osmosis (RO) membrane can be prepared by PP using the proper porous substrate and PP conditions. Reproducibility and continuous operation feasibility, semi-continuous PP using hollow fibers was examined using a special constructed tandem reactor. Factors influencing continuous PP and variation of resultant RO membrane characteristics as a function of reaction time were investigated. While further improvement in the maximum salt rejection (90%) should be possible, the obtained water flux was exceptionally good. Allylamine plasma polymers produced had high chemical stability under extreme conditions of pH and in free chlorine oxidizing environments, superior to commercial RO membranes. Grafting acrylic acid onto the membrane surface improved its desalination characteristics. Further, PP can be used in continuous operation with very good reproducibility. (Zielinski-MAXIMA)
W83-00260

PREPARATION OF THIN-ION-EXCHANGE MEMBRANES WITH EXCEPTIONALLY LOW RESISTANCES AND HIGH SELECTIVITIES.
Southern Research Inst., Birmingham, AL.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-108001, Price codes: A03 in paper copy, A01 in microfiche. Final Report, February, 1982. 37 p, 10 Fig, 7 Tab, 6 Ref, 1 Append. OWRT C-00107-5(0442)(1), 14-34-0001-0442.

Descriptors: *Ion exchange, *Desalination, *Membranes, *Design criteria, *Resins, Ion transport, Synthesis, Water treatment, Polymers, Thin films, Anion exchange, Cation exchange, Seawater, Saline water, Brackish water.

An investigation was carried out to develop improved ion-exchange membranes for desalting seawater or brackish waters with high salinities. Thin anion- and cation-exchange membranes were prepared that exhibit exceptionally low electrical resistances without sacrificing high current efficiencies (i.e., high selectivities) in solutions at seawater concentrations. The approach selected was based on filling (vacuum impregnation) the pores of thin microporous plastic (polypropylene) films with solutions of selected monomers. The monomers were subsequently polymerized and converted to anion- and cation-exchange resins. Laboratory reproducibility in the fabrication procedure for pinhole-free 6 in by 7 in membranes 1-2 mil thick was achieved. Anion-exchange membranes were fabricated with vinylbenzyl chloride 7.2% crosslinked by divinylbenzene (DVB) and post-quaternized with trimethylamine. Cation-exchange membranes were made with 2-acrylamido-2-methylpropanesulfonic acid 17% crosslinked by ethyleneglycol dimethacrylate, or from 5.5% styrene crosslinked by DVB and post-sulfonated with 2% of oleum. Dimensional and thermal stability are expected for these membranes since an appreciable volume of microporous film is not converted to an interpenetrating ion-exchange structure. Improved handling characteristics and lower replacement costs are anticipated. (Zielinski-MAXIMA)
W83-00261

DEVELOPMENT OF COMPOSITE HOLLOW FIBERS - PHASE III,
Bend Research, Inc., OR.
W. C. Babcock, R. W. Baker, R. P. Barss, B. A. Kruse-Smith, and H. K. Lonsdale.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-108068, Price codes: A03 in paper copy, A01 in microfiche. Final Report, April, 1982. 35 p, 13 Fig, 7 Tab, 8 Ref. OWRT C-00154-D(0508)(1), 14-34-0001-0508.

Descriptors: *Reverse osmosis, *Membrane processes, *Hollow fibers, *Salt rejection, *Feasibility studies, *Desalination, *Desalination apparatus, Desalination plants, Membranes, Demineralization, Design criteria, Saline water, Brackish water, Fouling, Hydraulic engineering, Industrial wastes, Wastewater treatment.

Previous work under this program to develop brackish water reverse osmosis (R) modules that employ inside-skinned composite hollow fibers, led to the development of polysulfone hollow fiber support membranes having a high burst pressure and suitable water permeability and to the demonstration of brackish water desalting capability for polyamide-coated fibers. Further research was directed towards developing and testing modules containing 10 sq ft of membrane area. A number of such modules were prepared that rejected over 95% salt and had fluxes of about 10 gallons/sq ft at 400 pounds/sq in. and 0.5 weight-% NaC1. The fouling resistance of these modules was demonstrated in field tests on pond water that contained about 1000 parts-per-million of suspended solids. In one test, a module was used for 40 days with only coarse filtration (100-micron filter) as pretreatment, during which, no significant module fouling occurred. These modules were also used in a plating shop for renovation of nickel-plating rinse waters. For this latter study, using only coarse filtration for pretreatment, no irreversible fouling occurred over 70 days of operation. Use of these modules can reduce RO desalting costs up to half. (Zielinski-MAXIMA)
W83-00267

DIATOMITE PRECOAT FILTRATION FOR PRETREATMENT OF SEAWATER PRIOR TO REVERSE OSMOSIS,
Manville Service Corp., Denver, CO.
G. R. Bell, and R. C. Himes.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-108092, Price codes: A12 in paper copy, A01 in microfiche. Final Report, July, 1982. 253 p, 38 Fig, 24 Tab, 8 Ref, 3 Append. OWRT C-90272-D (9520)(1), 14-34-0001-9520.

Descriptors: *Filtration, *Seawater, *Reverse osmosis, *Diatomaceous earth, *Financial feasibility, *Desalination, Water treatment, Saline water, Cost-benefit analysis, Design criteria, Water quality, Water quality control, Testing procedures, Feasibility studies, Process control.

Investigation established that diatomaceous earth (DE) filtration could more consistently produce acceptable reverse osmosis feed water (based on 15-minute plugging index (PI-15) test data) than an existing central pretreatment (CPT) system over a substantial assessment period. The DE product was at or below 45 or 85% of all cycles; the CPT system was at or below 45 for only 42% of the same test days. Further, the DE product met its target PI-15 value of 40 or less, 53% of the time. Using DE to filter CPT system product gave PI values at/below 40 for 90% of 73 readings made, despite some substantial CPT system operating problems. Installed DE capital costs would be only about 40% of that for current CPT replication. Estimated operating and maintenance costs slightly favor DE over the CPT system by 14.4 to 16.3 cents/1000 gallons, respectively; addition of amortization decreases the total DE cost to only 58% that of the CPT system product. Of the DE processes evaluated, two have the capability of producing low PI-15 water. One process uses aluminum-hydrate coated DE; the other uses a separate feed of a cationic polymer, followed by DE body feed. While these products have similar PI-15 values, their other characteristics have notable differences requiring testing. (Zielinski-MAXIMA)
W83-00270

3B. Water Yield Improvement

USE OF FRACTURE TRACES IN WATER WELL LOCATION: A HANDBOOK.
For primary bibliographic entry see Field 4B.
W83-00217

ANGORA GOATS FOR CONVERSION OF ARIZONA CHAPARRAL: EARLY RESULTS,
Rocky Mountain Forest and Range Experiment Station, Tempe, AZ.
O. D. Knipe.
In: Proceedings of the Symposium on Dynamics and Management of Mediterranean-Type Ecosystems, June 22-26, 1981, San Diego, California, Pacific Southwest Forest and Range Experiment Station General Technical Report PSW-58, 1982, p 264-269, 1 Fig, 3 Tab, 15 Ref.

Descriptors: *Water yield improvement, *Chaparral, *Brush control, *Goats, *Arizona, Grazing, Shrubs, Grasses, Vegetation, Fires.

Conversion of Arizona chaparral to grass significantly increases water and forage yields, reduces fire hazard, and may increase wildlife values. Use of goats to convert chaparral to grass may be an alternative to chemical and mechanical means of brush control. Following prescribed burning and seeding with weeping lovegrass in the fall, 242 angora wethers were introduced into a 210-acre enclosure in June. Results indicate that the trampling of grass seed by goats in burned -over chaparral promotes germination and establishment. Since the goats relish young grasses, areas must be protected during grass establishment. Prescribed burning and goat browsing resulted in decreased shrub cover, increased herbaceous cover, and an apparent reduction in fire hazard and improvement in water yield. Goats utilized a far wider range of vegetation in the Arizona chaparral than other domestic livestock and resident big game, but chaparral species most preferred by goats are comparable to those of other domestic livestock and game. (Moore-SRC)
W83-00299

STREAM WATER NUTRIENT CHANGES ASSOCIATED WITH THE CONVERSION OF ARIZONA CHAPARRAL,
Rocky Mountain Forest and Range Experiment Station, Tempe, AZ.
For primary bibliographic entry see Field 5B.
W83-00300

WATER YIELD CHANGES RESULTING FROM TREATMENT OF ARIZONA CHAPARRAL,
Rocky Mountain Forest and Range Experiment Station, Tempe, AZ.
A. R. Hibbert, E. A. Davis, and O. D. Knipe.
In: Proceedings of the Symposium on Dynamics and Management of Mediterranean-Type Ecosystems, June 22-26, 1981, San Diego, California, Pacific Southwest Forest and Range Experiment Station General Technical Report PSW-58, 1982, p 382-389, 5 Fig, 2 Tab, 10 Ref.

Descriptors: *Chaparral, *Water yield improvement, *Watershed management, *Streamflow, *Brush control, Herbicides, Shrubs, Fires, Grasses, *Transpiration, Perennial streams, Precipitation, *Arizona.

Chaparral shrubs transpire large amounts of water, leaving an average of only about 30 mm (1.2 inches) or 5% for streamflow. Transpiration can be reduced and streamflow increased by removing part or all of the shrubs and replacing them with shallow-rooted grasses and forbs. Annual streamflow from small chaparral watersheds, in a 600-750 mm rainfall zone, was increased 75-150 mm and changed from intermittent to perennial flow by converting brush to grass with herbicides. Increases lasted up to 18 years with maintenance. At drier sites (450 mm rainfall) increases averaged less than 15 mm. Burning increased streamflow for 3-4 years while brush regrew. Both storm and non-storm flows increased. About 85% of the increase occurs in 6 fall-winter months which get 60% of

the precipitation. Yearly increases tend to be exponentially related to precipitation. (Moore-SRC)
W83-00303

3C. Use Of Water Of Impaired Quality

WATER RECLAMATION AND REUSE,
Alberta Univ., Edmonton. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5D.
W83-00163

ADJUSTMENT OF SOIL LIMITATIONS,
Stellenbosch Univ. (South Africa).
For primary bibliographic entry see Field 2G.
W83-00286

3D. Conservation In Domestic and Municipal Use

ESTIMATING RUNOFF VOLUMES FROM URBAN AREAS,
Chalmers Univ. of Technology, Goeteborg (Sweden). Institutionen foer Vattenbyganad.
For primary bibliographic entry see Field 4A.
W83-00007

SOCIAL AND POLITICAL ASPECTS OF DROUGHT,
Kraeger Associates, Ltd., Aptos, CA.
For primary bibliographic entry see Field 6B.
W83-00186

WATER RESOURCE SYSTEM RELIABILITY UNDER DROUGHT CONDITIONS: THE SEATTLE WATER SUPPLY SYSTEM AS A CASE STUDY,
Washington Univ., Seattle. Dept. of Civil Engineering.
S. H. Draper, R. N. Palmer, D. P. Lettenmaier, and S. J. Burgess.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-108357, Price codes: A05 in paper copy, A01 in microfiche. Technical Report No 72, September 1981. 89 p, 21 Fig, 12 Tab, 28 Ref, 2 Append. OWRT B-080-WASH(1), 14-34-0001-9102.

Descriptors: *Drought, *Water supply systems, *Water supply development, *Model studies, *Urban planning, Available water, Water repairments, Water management, Water supply, Mathematical studies, Water shortage, Water deficit, Drought resistance, Forecasting, Hydrologic aspects, Prediction, Projections, Weather Forecasting.

Several potential ways of increasing the resistance of water supply systems drought conditions through improved management/planning were examined, using the Cedar and Tolt River systems of western Washington. The use of drought indices to define/forecast hydrologic drought was assessed, particularly for the widely-used Palmer Drought Index; this index generally provided less accurate forecasts of future runoff deficiencies than hydrologic forecasting methods in current use. Simulation modeling appeared to be a more useful drought management tool. A detailed simulation model of the Cedar/Tolt system was developed that incorporates a method for characterizing system reliability in terms of supply deficits. The model study found that the proposed Seattle Water Department system expansion is needed if the system is to supply projected demands reliability by the year 2000; system reliability would be markedly improved by implementation of the city plan to increase the volume of active storage in the Cedar River reservoir. Further, the model study indicated that a Cedar reservoir seepage loss reduction may significantly improve system reliability, contrary to earlier analysis findings. The effects of alternate operating policies on system reliability and the role of instream flow needs and Lake Washington management are also assessed. The model study illustrates the advantages of a demand-deficit approach over conventional safe yield analysis. (Zielinski-MAXIMA)
W83-00229

CASE STUDY ANALYSES OF 208 PROGRAM EFFECTIVENESS IN IMPROVING REGIONAL WATER RESOURCES MANAGEMENT,
Brown and Caldwell, Pasadena, CA.
For primary bibliographic entry see Field 6B.
W83-00240

3E. Conservation In Industry

WATER AND WASTE MANAGEMENT IN THE CANADIAN MEAT AND POULTRY PROCESSING INDUSTRY.
Stanley Associates Engineering Ltd., Edmo Edmonton (Alberta); and Dearborn Environmental Consulting Services, Mississauga (Ontario).
Report No. EPS 3-WP-81-3, June, 1981. 207 p, 44 Fig, 58 Tab, 158 Ref, 4 Append.

Descriptors: *Water management, *Waste management, *Canada, *Meat processing industry, *Poultry, Food processing industry, Water conservation, Industrial water, Water use, Water use efficiency, Water users, Waste disposal, Solid wastes, Liquid wastes, Waste recovery.

Following visits to Canadian and American meat/poultry processing plants to assess water and waste management practices, demonstration studies were conducted at two Canadian red meat and two Canadian poultry processing facilities to document the feasibility for in-plant control of water use and process effluent waste loadings. These studies confirmed that water use and waste load reductions could be accomplished at minimal cost. The major areas of water use reduction in the red meat processing plants involved shroud washing processes, employee handwashers, carcass washers, and viscera table washing systems; for poultry processing plants, this involved coop washing, feather transport, gooseneck handwashers, and rotary screen backwashing. Considerable process effluent waste load reductions at both red meat plants were attained, mostly by improving the blood recovery systems (in which process effluent BOD-5 was reduced from 48-56%). No significant decrease in waste loads was attained at either of the poultry processing plants. The maximum cost of any single modification installed was $7700 (blood recovery system); the average cost of all other modifications was about $500. At all four plants, modification costs could be recovered in less than one year. Reuse/recycle schemes were also identified. (Zielinski-MAXIMA)
W83-00082

PULP AND PAPER EFFLUENT MANAGEMENT,
Tufts Univ., Medford, MA.; and National Council for Air and Stream Improvement, Inc., Medford, MA.
For primary bibliographic entry see Field 5D.
W83-00164

WATER MANAGEMENT IN THE OIL SHALE INDUSTRY,
CH2M/Hill, Bellevue, WA.
For primary bibliographic entry see Field 5D.
W83-00185

3F. Conservation In Agriculture

POLICY OBJECTIVES AND INFORMATION SYSTEM FOR IRRIGATION PROJECTS-INDIA,
Center for Development Research, Hyderabad (India).
For primary bibliographic entry see Field 6A.
W83-00011

IRRIGATION PLANNING IN THE TANA BASIN OF KENYA,
University Coll. of Swanea (Wales). Centre for Development Studies.
For primary bibliographic entry see Field 6B.
W83-00015

THE PROBABILITY DISTRIBUTION OF WATER INPUTS AND THE ECONOMIC BENEFITS OF SUPPLEMENTARY IRRIGATION,
International Inst. for Applied Systems Analysis, Laxenburg (Austria).
For primary bibliographic entry see Field 6A.
W83-00016

CLIMATIC ASPECTS OF DROUGHTS,
Maryland Univ., College Park. Dept. of Meteorology.
H. E. Landsberg.
Bulletin of the American Meteorological Society, Vol 63, No 6, p 593-596, June, 1982. 1 Tab, 34 Ref.

Descriptors: *Climatic data, *Temporal distribution, *Drought, *Water management, *Land management, Water deficit, Water shortage, Overdraft, Precipitation, Crop production, Semiarid lands, Runoff.

Due to the devastating effects of drought on crop production, much attention has been focused on understanding reccurrence intervals of drought conditions. Analysis of long-time-series-of-occurrence data from many parts of the world suggests that drought incidence is usually characterized by the long wave pattern and by weakening of the intertropical convergence zone. Many indistinct regularities are common, but once a drought is established, its temporal persistence over several months is marked. Interannual persistence is infrequent. The prediction of drought is still in the experimental stages. In efforts to control the disastrous impact of drought conditions, major consideration must be given to land use. Mismanagement of land resources in semi-arid regions can lead to desert encroachment. Rehabilitation after desert sands have taken oven, even when rains return, is a lengthy and costly struggle. In the meantime, greater water management skills will be needed to counteract the effects of drought on soil erosion, crop production, water supplies and hydroelectric power generation. (Geiger-FRC)
W83-00188

APPLICATION OF REMOTE SENSING IN EVALUATING FLOODWATER FARMING ON THE PAPAGO INDIAN RESERVATION,
Arizona Univ., Tucson. Office of Arid Lands Studies.
C. Hutchinson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-108365, Price codes: A06 in paper copy, A01 in microfiche. Completion Report, March, 1982. 101 p, 10 Fig, 7 Tab, 49 Ref, 5 Append. OWRT C-90258-G (0515)(1).

Descriptors: *Remote sensing, *Floodwater, *Wastewater farming, *Crop production, *Rainfall-runoff relationships, Farming, Water use, Available water, Surveys, Farms, Irrigation water, Catchments, Growth rates, Reservoir storage, Precipitation, *Arizona, *Papago Indian Reservation.

The geographic setting and ecological functions of the traditional farming system are described. A survey of the fields revealed that cultivated acreage decreased from 3068 in 1913 to 125 in 1981. Hydrologic computer modeling was performed for one of the surveyed fields by estimating bimonthly water yield of the water catchment during the July-October growing season, and compared to consumptive use requirements of the crops. Crop success appeared related to growing seasons having more evenly-distributed bimonthly water yields. However, total seasonal water yield may not reflect crop success when rains are concentrated in one or two bimonthly periods. Further, ephemeralized crops are deemed more successful than water use efficient crops with longer growing seasons. Crop success probability can be improved by farmers by managing floodwater delivery to fields

in two ways: storage of soil moisture in the soil of the cultivated fields; reservoir storage of floodwater for irrigation during critical dry periods. Current Papago water/crop management practices have been little-affected by modern technologies; they, rather, are local adaptations of native American/historic Hispanic methods refined over centuries. (Zielinski-MAXIMA)
W83-00230

VARIABILITY IN CROP PHYSIOLOGICAL AND MORPHOLOGICAL CHARACTERISTICS CONTROLLING WATER USE EFFICIENCY AND GRAIN YIELD,
Nebraska Univ.-Lincoln. Inst. of Agriculture and Natural Resources.
J. D. Eastlin, C. Y. Sullivan, and C. A. Francis.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-108407, Price codes: A0

Descriptors: *Water efficiency, *Irrigation practices, *Crop yield, *Plant physiology, *Plant morphology, *Grain crops, Crop production, Irrigation water, Irrigation efficiency, Plant growth, Agriculture, Farming, Soil water, Sorghum, Corn, Thermal stress, Temperature effects, Water use.

Water and temperature stress variables were imposed on sorghum, pearl millet, and corn in growth room and field tests to evaluate comparative performances. Seed number correlates positively with grain yield in most cereals; seed number per sq m was considerably more stable under stress in sorghum than in corn. Temperatures 5 degrees above ambient at night in sorghum field tests for weekly intervals during panicle development reduced yields the most (28%) during the week following appearance of pistil and stamen primordia. This reduction paralleled a 29% seed number reduction, primarily due to the lack of floret formation than floret abortion. Root production was rapid during panicle development prior to bloom, and may be a competing sink to the panicle. A stress-tolerant sorghum hybrid produced roots at half the oxygen consumption rate as a normal hybrid. Line source water-gradient comparisons between corn and sorghum in Kansas and Nebraska showed sorghum as more stable in grain yield and the seed number component of the yield. Water use efficiencies were higher for sorghum on dryland and low (at/below 4 inches) irrigation levels, while those for corn were higher at higher irrigation levels, mainly due to a 75% longer grain filling period. (Zielinski-MAXIMA)
W83-00234

WATER-USE PRODUCTION FUNCTIONS OF SELECTED AGRONOMIC CROPS IN NORTHWESTERN NEW MEXICO, PHASE I,
New Mexico State Univ., Las Crucas. Dept. of Agricultural Engineering.
C. E. Kallson, E. J. Gregory, and E. J. Sammis.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-108415. New Mexico Water Resources Research Institute, Las Crucas, WRRI Report No 137, August, 1981. 94 p, 13 Fig, 30 Tab, 10 Ref, 3 Append. OWRT C-90229 (9444)(1).

Descriptors: *Irrigation practices, *New Mexico, *Agronomic crops, *Mathematical equations, *Crop yield, Irrigation water, Water use, Water use efficiency, Fertilization, Crop production, Consumptive use, Nitrogen, Evapotranspiration, Hydroscopic coefficient, Mathematical studies, Mathematical models, Model studies, Water supply.

Effective irrigation practices require a knowledge of the consumptive use requirement of the given crop; consumptive water use as influenced by the level of nitrogen fertilization was investigated for spring barley, pinto beans, and field corn in northwestern New Mexico for the 1980 growing season. Potential evapotranspiration was calculated by several methods, and crop coefficients were developed. Crop yield was demonstrated to be significantly and highly correlated to seasonal evapotranspiration. Crop coefficients greater than unity were routinely achieved at the higher yield levels which occurred during peak evapotranspiration. As the level of nitrogen fertility was increased (from 10 to 200 kg/hectare), the maturation period of the crop lengthened and its growth rate increased. The level of nitrogen fertility, however, did not appear to affect the water use efficiency of the developing crop. Both linear and curvilinear water production functions were produced, with the form of the function varying with the crop. Grain corn yield was accurately predicted using the seasonal consumptive use by a previously-developed water production function. Water production functions for all three crops are presented in respective equation. Further study will allow for a refining of the investigative technique used, as well as for a replication of the experimental methods between different seasons. (Zielinski-MAXIMA)
W83-00235

RURAL WATER SUPPLY SYSTEMS: IMPROVED PLANNING STRATEGIES THROUGH SYSTEMS ANALYSIS,
Iowa State Univ., Ames. Dept. of Civil Engineering.
For primary bibliographic entry see Field 6A.
W83-00241

EFFICIENT USE OF WATER FOR IRRIGATION IN THE UPPER MIDWEST,
Iowa State Water Resources Research Inst., Ames.
T. A. Austin, C. E. Anderson, H. P. Johnson, R. H. Shaw, and J. Golchin.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-108464, Price codes: A07 in paper copy, A01 in microfiche. Completion Report ISWRRI-117, June 1982. 145 p, 23 Fig, 29 Tab, 8 Ref, 1 Append. OWRT B-120-ILL(5).

Descriptors: *Irrigation efficiency, *Surface water availability, *Hydrologic budget, *Hydrologic models, *Agricultural hydrology, *Computer programs, Irrigation, Available water, *Soil moisture deficiency, Irrigation operation, Irrigation practices, Irrigation requirements, Irrigation water, *Midwest U.S., Water storage, Groundwater availability, Computer models, Hydrologic budget, Model studies, Corn, Crop yield.

Land used for irrigation in the upper Midwest U.S. region (including Indiana, Illinois, Wisconsin, Minnesota, Iowa, Missouri) increased almost 3-fold from 1969-1979. Assessment was made of ground and surface water availability for further irrigation expansion. The most probable irrigation expansion areas appear to be lands near alluvial aquifers associated with major rivers, or in areas where bedrock aquifers are near the surface. Adequate surface water resources are available for further irrigation development, particularly in the southern half of the region. Carryover water storage will probably be needed, however, for protection during annual short-term variations in surface water resources and against long-term droughts. Direct diversions to assist irrigation water needs will only be possible from the major region rivers and their tributaries. A water balance computer model predicted the frequency of soil moisture for soils typical to the region. Soil moisture shortage occurs on days when soil moisture in the top 5 feet is less than 50% of the available soil moisture. A soil moisture/crop yield computer program was used to predict increases in corn yield due to irrigation. Prediction of yield increases were made for Lamberton, Minnesota and for Fayette County, Illinois. (Zielinski-MAXIMA)
W83-00242

DENDROGRAPHY FOR OPTIMAL WATER AND ENERGY UTILIZATION IN PLANT GROWTH,
Iowa State Univ., Ames.
C. P. Burger, R. B. Hall, and L. C. Promnitz.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-108043, Price codes: A06 in paper copy, A01 in microfiche. Iowa State Water Resources Research Institute Report ISWRRI-101, Iowa State University, Ames, July, 1982. 105 p, 9 Fig, 18 Ref, 4 Append. OWRT B-062-IA(7), 14-34-0001-8086.

Descriptors: *Water stress, *Plant growth, *Statistical analysis, *Strain gages, Irrigation practices, Water requirements, Water use, *Soybeans, *Poplar Trees, Statistics, Electrical resistance, Electrical properties, Error analysis, Drought, Computer models, Temperature effects.

Study was made of water stress and growth in young poplar trees and soybeans using a new technique involving electrical resistance strain gages. The principal sources of error introduced by the gages and data acquisition equipment were evaluated and overcome. Errors caused by temperature fluctuations were found to be small, compared to the physiological responses of the plants to daytime temperature changes. Two large-scale statistical tests were completed: the first established the nature of individual and coupled effects of light and ambient temperature on evaporation, growth and stem changes of young trees; the second assessed the effect of small soil mineral differences on plant drought resistance. Phosphate deficiencies were found particularly harmful. Extensive soybean field tests confirmed the value of the new strain technique in short term evaluation of different planting patterns, and of irrigation procedures on water stress development in soybeans. Stem size change tests attributable to xylem/bark contractions showed that the xylem is not rigid (as often assumed in plant water stress models), and illustrated sap flow changes that occur when a plant is severely stressed and able to recover and when it is damaged and suffers physiological damage. (Zielinski-MAXIMA).
W83-00265

INCENTIVES FOR IRRIGATION WATER CONSERVATION IN AGRICULTURE,
Texas Tech Univ., Lubbock. Dept. of Industrial Engineering.
B. K. Lambert, S. S. Panwalkar, and S. Kajila.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-108159, Price codes: A05 in paper copy, A01 in microfiche. Completion Report, May, 1982. 67 p, 2 Fig, 15 Tab, 29 Ref, 1 Append. OWRT B-251-TEX(1), 14-34-0001-1270.

Descriptors: *Irrigation water, *Water conservation, *Irrigation practices, *Cost analysis, *Model studies, Irrigation, Irrigation districts, Texas, Irrigation efficiency, Irrigation operation, Irrigation requirements, Sprinkling, Sprinkler irrigation, Surface irrigation, Cost-benefit analysis, Tangible benefits, Cost sharing Economic aspects, Financing.

Potential irrigation water conservation incentives for the Texas High Plains region were examined, and the opinion of area growers was assessed relative to the desirability/effectiveness of these potential incentives. Economic analysis of sprinkler/surface irrigation systems was conducted using the Life Cycle Costing (LCC) method to determine the impact of potential economic incentives on irrigation system selection. These incentives included: accelerated depreciation methods; low interest loans having different repayment schedules; and cost sharing. The ancillary impact of inflation and rising energy costs were included in incentives evaluation. Analyses indicated that low interest loans coupled with favorable depreciation methods may provide a feasible incentive for water-conserving equipment purchases (e.g., sprinkler systems). Current incentive programs are accepted by farmers and should continue, with further emphasis on the availability of technical help and demonstration projects, and an improved method for cost sharing or the development of low interest loans with a favorable repayment schedule. Discussions with area growers produced suggestions for improving existing incentive programs and for potential future irrigation water conservation incentives. (Zielinski-MAXIMA)
W83-00278

WATER SAVING TECHNIQUES,
Texas Agricultural Experiment Station, Lubbock.
W. M. Lyle.
In: Proceedings of the Twenty-Seventh Annual New Mexico Water Conference, Hope for the

High Plains, April 1-2, 1982. WRRI Report No 145, May 1982. p 72-82, 4 Tab, 4 Ref, New Mexico Water Resources Research Institute, New Mexico State University, Las Cruces.

Descriptors: *Irrigation, *Furrow irrigation, *Sprinkler irrigation, *Trickle irrigation, *Irrigation efficiency, *Application rates, Rainfall penetration, Water use efficiency, Soil moisture retention, Cost analysis, Optimal yield, Irrigation practices, Irrigation requirements, Water loss, Water potentials, *New Mexico, Water conservation.

Eastern New Mexico's water resources include irrigation water and rainfall. For an effective irrigation-soil-crop system, maximum amounts of water must be stored in the soil root zone. Controlling the flow of water produces the highest efficiency. Conventional furrow and sprinkler systems have to many variables--soil intake rates, soil nonhomogeneity, length of run, slope--to give precise control. A low energy-precision application)LEPA) system was designed which distributes water directly to the furrows at very low pressure through drop tubes and orifice controlled emitters and is used in conjuction with microbasin land preparation. Little water loss occurred during LEPA testing; the average application efficiency was over 98% when used with the furrow dikes which are necessary to the system. To obtain water use efficiency each irrigation treatment (LEPA, sprinkler, furrow) was applied to either basin or conventionally tilled land. The average yield from each treatment was divided by the gross water applied, and varied from 2.07 to 2.76 over the two year period. The LEPA system could decrease energy consumption by lowering net irrigation requirements through great rainfall retention in supplemental irrigated areas, by high application efficiency, by high distribution efficiency, and by lowering operating head requirements. A summary table shows net returns realized by each treatment over the irrigation energy expense, using an example of soybeans at $8.00/bushel (1980) and $5.00/bushel (1981) and a $0.05/kw-hr energy cost. The best return was the basin tilled LEPA system at $442.40; the worst was the conventional tilled sprinkler system at $307.20. (Atkins-Omniplan)
W83-00309

IRRIGATION SCHEDULING,
Nebraska Univ., Lincoln. Dept. of Agricultural Engineering.
J. R. Gilley.
In: Proceedings of the Twenty-Seventh Annual New Mexico Water Conference, Hope for the High Plains, April 1-2, 1982. WRRI Report No 145, May 1982. p 83-92, 1 Fig, 3 Ref. New Mexico Water Resources Research Institute, New Mexico State University, Las Cruces.

Descriptors: *Irrigation scheduling, *Irrigation efficiency, *Irrigation practices, *Soil moisture deficiency, *Monitoring, Hydrologic budget, Optimal yield, Crop yield, Soil types, Hydrologic models, Evapotranspiration, Climatic data, Rainfall infiltration.

Irrigation water management is important for reasons that include water and energy conservation, reduced production costs, and yield improvements. Irrigation scheduling is a determination of when and how much to irrigate with an additional component of specific management objectives, such as maximum yield or economic benefit, minimum leaching, or maintaining the salt balance. The agricultural engineering department at the University of Nebraska has developed an irrigation scheduling model called IRRIGATE for the agricultural computer network (AGNET) system. The basic component of the model is the on-farm water balance, which is the disposition of water during and after an irrigation event. IRRIGATE can be used with a variety of irrigation systems, nine common crops, eight soil types, and a minimum of climactic data. Soil moisture depletions should not exceed a particular value (usually 50% of the soil's available water holding capacity) to prevent crop stress and yield decline. The model automatically builds and maintains a field file which stores rainall, irrigation and soil moisture data. Irrigations are scheduled based on the soil moisture depletions at the two extreme positions of a field, the normal start and stop positions of an irrigation cycle. Periodic soil moisture readings provide the necessary feedback to ensure that scheduling is based on the best estimate of soil moisture depletion. Depending on soil type, various types of soil monitors are used. The output of the program has three components: the update; forecast; and schedule. (Atkins-Omniplan)
W83-00310

CONSERVATION THROUGH CROPS RESEARCH,
New Mexico State Univ., Las Cruces. Dept. of Agronomy.
M. H. Niehaus.
In: Proceedings of the Twenty-Seventh Annual New Mexico Water Conference, Hope for the High Plains, April 1-2, 1982. WRRI Report No 145, May 1982. p 122-127, New Mexico Water Resources Research Institute, New Mexico State University, Las Cruces.

Descriptors: *Irrigation, *Irrigation effects, *Water conservation, *Crop production, *Research priorities, Crop yield, Water management, Water supply, Water shortage, Tolerance, Drought resistance, Alfalfa, Sorghum, Cotton, *New Mexico.

Research is underway or being planned to identify crops that will conserve New Mexico's increasingly scarce and expensive irrigation water. This paper discusses research on conventional existing crops and research on new crops. In 1979, a hybrid cotton showed a 3 to 36% yield advantage over conventional cotton and produced more fiber per unit of water. Cotton can also be predisposed to require either more or less water by the amount and timing of irrigation during early growth. Alfalfa, which is drought tolerant, is New Mexico's most important cash crop. A current project has shown that there is greater variation in alfalfa for its ability to grow and produce when given limited water and that this characteristic can be passed on to the next generation. Research on sorghum, also a drought resistant crop, is aimed at higher yield of protein. Researchers have found that use of antitranspirants can increase sorghum and other crop yields, particularly when water is limiting. Furrow diking and water harvesting have also resulted in yield increases. New areas of research center on introducing new crop species to the southwest from other parts of the world and on domesticating wild species. Crops currently being studied include: crambe, a seed high in oil, which has a short growing season and, therefore, uses less water than other crops; guar, which does well on poor soil and also uses little water; kochia, which researchers are trying to convert from a weed to a desirable forage crop; jojoba; and millet. Unfortunately, funding is limited, which hampers the much needed research to find and develop these and other species into crops adapted to the arid southwest. (Atkins-Omniplan)
W83-00311

4. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control Of Water On The Surface

ESTIMATING RUNOFF VOLUMES FROM URBAN AREAS,
Chalmers Univ. of Technology, Goeteborg (Sweden). Institutionen foer Vattenbyganad.
V. Arnell.
Water Resources Bulletin, Vol 18, No 3, p 383-387, June, 1982. 4 Fig, 2 Tab, 12 Ref.

Descriptors: *Runoff volume, *Rainfall-runoff relationships, *Urban drainage, *Mathematical models, Mathematical studies, Mathematical equations, Urban areas, Regression analysis, Catchment areas, Model studies, Rainfall.

An equation for estimating runoff volumes from urban areas was formulated based on the part of a total area contributing to runoff, the rainfall amount for a single event, and the initial rainfall losses. For the evaluation of the part of a total area contributing to runoff and the initial rainfall losses, rainfall/runoff measurements were taken in five residential catchment areas ranging in size from 0.035 sq km to 1.450 sq km. Initial rainfall losses were found to vary from 0.38 mm to 0.70 mm for the different test sites according to linear regression analysis of rainfall volumes versus runoff volumes. The parts of the areas contributing to runoff were proportional to the impermeable parts of the areas. The present equation may be applied to the estimation of runoff volume in urban sections with well defined paved surfaces and roofs and with a negligible amount of runoff from permeable areas. (Geiger-FRC)
W83-00007

WATER RESOURCES DATA, LOUISIANA, WATER YEAR 1981--VOLUME 2. SOUTHERN LOUISIANA.
Geological Survey, Baton Rouge, LA. Water Resources Div.
For primary bibliographic entry see Field 7C.
W83-00057

LOW-FLOW CHARACTERISTICS AND FLOW DURATION OF NEW JERSEY STREAMS,
Geological Survey, Trenton, NJ. Water Resources Div.
For primary bibliographic entry see Field 7C.
W83-00061

REPORT OF THE ANNUAL YIELD OF THE ARKANSAS RIVER BASIN FOR THE ARKANSAS RIVER BASIN COMPACT, ARKANSAS--OKLAHOMA, 1980 WATER YEAR,
Geological Survey, Little Rock, AR. Water Resources Div.
G. L. Ducret, Jr.
Available from the OFSS, USGS Box 25425, Fed. Ctr. Denver, CO 80225, Price: $3.50 in paper copy, $3.50 in microfiche. Open-File Report 82-168, 1982. 25 p, 1 Fig, 3 Tab, 2 Ref.

Descriptors: *Streamflow, *Interstate compacts, *Water yield, Reservoir storage, Hydrologic data, River basins, *Arkansas, *Oklahoma, *Arkansas River basin.

The computed annual yield and deficiency of the subbasins as defined in the Arkansas River Compact, Arkansas-Oklahoma, 1980, are presented. Actual runoff from the subbasins and depletion caused by major reservoirs in the compact area are also given. Monthly, maximum, minimum, and mean discharges are shown for the 14 streamflow stations used in computing annual yield. (USGS)
W83-00063

POTENTIAL FLOOD AND DEBRIS HAZARDS AT COTTONWOOD COVE, LAKE MEAD NATIONAL RECREATION AREA, CLARK COUNTY, NEVADA,
Geological Survey, Carson City, NV. Water Resources Div.
For primary bibliographic entry see Field 2E.
W83-00070

ANNUAL PEAK DISCHARGES FROM SMALL DRAINAGE AREAS IN MONTANA THROUGH SEPTEMBER 1981,
Geological Survey, Helena, MT. Water Resources Div.
For primary bibliographic entry see Field 2E.
W83-00071

WATER-RESOURCES INVESTIGATIONS OF THE U.S. GEOLOGICAL SURVEY IN NEW MEXICO, FISCAL YEAR 1980.
Geological Survey, Albuquerque, NM. Water Resources Div.
For primary bibliographic entry see Field 7A.
W83-00073

SELECTED HYDROLOGIC AND CLIMATOLOGIC DATA FROM THE PRAIRIE DOG CREEK BASIN, SOUTHEASTERN MONTANA, WATER YEAR 1980,
Geological Survey, Helena, MT. Water Resources Div.
For primary bibliographic entry see Field 7C.
W83-00074

ADAPTATION OF THE ILLUDAS MODEL TO A DESK-TOP COMPUTER,
Canada Centre fro Inland Waters, Burlington (Ontario).
For primary bibliographic entry see Field 7B.
W83-00081

HYDROLOGY AND WATER RESOURCES OF THE DRAKENSBERG,
Natal Univ., Durban (South Africa). Dept. of Agricultural Engineering.
R. E. Schulze.
Report No. 6 (Natal Town and Regional Planning Reports, Vol 42), 1979. 179 p, 70 Fig, 22 Tab, 112 Ref.

Descriptors: *Water supply, *Statistical methods, *Soil erosion, Hydrologic aspects, *South Africa, Water resources development, Rainfall, Surveys, Decision making, Planning, Droughts, Nonlinear programming, Flow index, Model studies, Mathematical studies, Rainfall intensity, Rainfall impact, Regression analysis, Soil conservation, Drakensberg mountains, Umzimkulu river system.

The Drakensberg mountain range, together with its foothills and adjacent flatlands, is of particular signirce area of the country's water supply. It affords large annual and seasonal water to augment deficits elsewhere. A survey of the hydrology and water resources of the Drakensberg was undertaken to assist decision makers and planning strategies. A number of findings were made. Agricultural droughts (below 25 mm rainfall in 21 days) averaged from 0.24 times (summer) to 1.32 times (winter). The mapping of patterns of rainfall amounts constituting upper rainfall limits for drought and severe drought years and wet seasons afforded a statistical method having planning implications for identifying drought areas. A nonlinear statistical relationship was derived linking streamflow and rainfall. One significant finding from a planning aspect (from analysis of monthly streamflow data) was the vast potential of the Umzimkulu river system, which displayed not only high flows but also low coefficients of variability of flow. Tests of soil loss elimination model for South Africa revealed that the model was particularly sensitive to inputs of rainfall energy and soil erodibility. The results of this survey should assist objective decisions by public/private authorities concerned with the Drakensberg hydrology and water resources. (Zielinski-MAXIMA)
W83-00085

THE ANALYSES OF AREAL RAINFALL USING MULTI-QUADRIC SURFACES,
Department of Water Affairs, Pretoria (South Africa). Div. of Hydrology.
For primary bibliographic entry see Field 2B.
W83-00088

STREAMFLOWS AND CHANNELS OF THE GREEN RIVER BASIN, WYOMING,
Geological Survey, Cheyenne, WY. Water Resources Div.
H. W. Lowham.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-207416, Price codes: A05 in paper copy, A01 in microfiche. Water-Resources Investigations 81-71, May 1982. 73 p, 36 Fig, 4 Tab, 28 Ref.

Descriptors: *Streamflow, *Flow characteristics, *Channel morphology, *Dye releases, Tracers, Channel erosion, Stream banks, Gaging stations, Data collections, Discharge measurement, Regional analysis, Flood peak, Bankfull stage, Traveltime, *Wyoming, Green River basin.

Width, depth, cross-sectional area, and velocity of streamflow were depicted for 51 gaged sites in or near the Green River basin of Wyoming by summarizing data obtained from current-meter discharge measurements. Using these at-a-station relations as a base, regional relations were then developed that characterize hydraulic features of streams throughout the study area. Channel size is an indication of flow magnitude. High flows affect channel formation, and the annual peak-flow array is a representation of these flows. The geometric mean of this array is a viable statistical index of channel-forming flows because it represents the relative magnitude of high flows at a site. Bankfull discharge is a physical index of flows dominating channel formation. The magnitude of the geometric mean approximately equates to bankfull discharge, on the average. Relations depicting hydraulic characteristics of a discharge equal to the geometric mean of annual peak flows may, therefore, be considered to be generally representative of channel conditions existing during bankfull discharge. The relations have application for predicting channel response to developments that would alter streamflow. (USGS)
W83-00122

WATER-QUALITY ASSESSMENT OF STEINER BRANCH BASIN, LAFAYETTE COUNTY, WISCONSIN,
Geological Survey, Madison, WI. Water Resources Div.
S. J. Field, and R. A. Lidwin.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-215757, Price codes: A04 in paper copy, A01 in microfiche. Water-Resources Investigations 81-52, March 1982. 58 p, 17 Fig, 21 Tab, 27 Ref.

Descriptors: *Water quality, *Agricultural watersheds, *Streamflow, *Stream discharge, Erosion, Nonpoint pollution sources, Path of pollutants, Suspended sediments, Sediment yield, Water temperature, Dissolved solids, Data collections, Sampling, Water analysis, Nutrients, Nitrogen, Phosphorus, Storm runoff, *Wisconsin, Lafayette County, Steiner Branch basin.

Steiner Branch basin in southwestern Wisconsin has rugged mature topography where few conservation practices are followed to reduce soil losses. This report assesses the magnitude and types of nonpoint discharges that affect the water quality of Steiner Branch. The 1978 water year discharge was about 90% of the average and the 1979 discharge was 120% of average. Streamflow during the 2-year study period ranged from 1.5 cubic feet per second, which is approximately the low flow that occurs on the average of once every 2 years, to 392 cubic feet per second, a discharge of about a 5-year flood-recurrence interval. Suspended-sediment yields were 369 tons per square mile in the 1978 water year and 84.6 tons per square mile in 1979. These yields were 1.66 times higher than those monitored in an adjoining basin where more typical conservation practices were employed. However, sediment discharge per unit of stream discharge was only 1.30 times higher in the Steiner Branch basin than in the adjoining basin. The estimated long-term annual suspended-sediment yield for the Steiner Branch basin is 444 tons per square mile. The majority of the nutrient load of the stream was transported during runoff events whereas transport of nitrite plus nitrate nitrogen and total nitrogen occurred primarily during baseflow conditions. (USGS)
W83-00123

INVESTIGATION OF TRENDS IN FLOODING IN THE TUG FORK BASIN OF KENTUCKY, VIRGINIA, AND WEST VIRGINIA,
Geological Survey, Reston, VA. Water Resources Div.
R. M. Hirsch, A. G. Scott, and T. Wyant.
Available from Supt. of Documents, GPO, Washington, DC 20402, Price, $4.75. Water-Supply Paper 2203, 1982. 37 p, 24 Fig, 16 Tab, 38 Ref, 5 Append.

Descriptors: *Floods, *Statistical analysis, *Small watersheds, *Land use, Flood peak, Flood recurrence interval, Rainfall, Storm runoff, Flood plains, Sediments, Flow characteristics, Strip mines, Flood data, *Tug Fork basin, Kentucky, Virginia, West Virginia.

Statistical analysis indicates that the average size of annual flood peaks of the Tug Fork (West Virginia and Kentucky) has been increasing. However, additional statistical analysis does not indicate that flood levels exceeded typically once or twice a year in the period 1947-1979 are any more likely to be exceeded now than in 1947. Possible trends in stream-channel size are also investigated at three locations. No discernible trends in channel size are noted. Further statistical analysis of the trend in the size of annual flood peaks shows that much of the annual variation is related to local rainfall and to the 'natural' hydrologic response in a relatively undisturbed subbasin. However, some statistical indication of trend persists after accounting for these natural factors, though it is of borderline statistical significance. This suggests the need for further study in the basin that may relate flood magnitudes to both rainfall and to land use. (USGS)
W83-00128

WATER RESOURCES DATA FOR NEW YORK, WATER YEAR 1981--VOLUME 3. WESTERN NEW YORK.
Geological Survey, Albany, NY. Water Resources Div.
For primary bibliographic entry see Field 7C.
W83-00131

WATER RESOURCES DATA FOR NORTH CAROLINA, WATER YEAR 1981.
Geological Survey, Raleigh, NC. Water Resources Div.
For primary bibliographic entry see Field 7C.
W83-00132

AQUATIC WEED CONTROL WITH ENDOTHALL IN A SALT RIVER PROJECT CANAL,
F. G. Corbus.
Journal of Aquatic Plant Management, Vol 20, p 1-3, January, 1982. 1 Fig, 2 Tab, 2 Ref.

Descriptors: *Herbicides, *Aquatic weed control, *Canals, Weed control, Aquatic weeds, Water supply, Municipal water, Algal control, Performance evaluation, Surface water, Arizona, Salt River Project, Tempe Canal.

Few methods of aquatic weed control are acceptable or practical where municipal and industrial quality water is required. The effectiveness of Hydrothol 191 in controlling aquatic weeds was investigated in the Salt River Project 10 mile Tempe Canal, located in south central Arizona. Hydrothol 191 is the mono (N,N-dimethylalkylamine) salt of 7-oxabicyclo(2,2,1)heptane-2,3-dicarboxylic acid. Seven applications of Hydrothol 191 at 0.2 parts per million (ppm) active ingredient were made at 2 week intervals in the Canal. The Tempe Canal empties into the Western Canal which, except for the first 0.5 mile, was treated with acrolein at the same 2 week intervals. Hydrothol 191 is currently in the advanced stage of Environmental Protection Agency (EPA) label consideration for a 3 ppm unrestricted use in municipal and industrial water sources and is available for municipal and industrial water use in Arizona for applications at 0.2 ppm. Hydrothol 191 was effective in controlling both sago pondweed (Potamogeton pectinatus L.) and filamentous algae, primarily Cladophora and Spirogyra, in the 10 miles of the Tempe Canal. Sago pondweed was eliminated in one stretch of the canal and nearly eliminated in another in response to the treatment. No synergism between Hydrothol 191 and acrolein was observed in the Western Canal. (Carroll-FRC)
W83-00166

AN ALTERNATIVE TO THE PERIPHERAL CANAL,
California Univ., Davis. Dept. of Civil Engineering.
For primary bibliographic entry see Field 6G.
W83-00193

RESERVOIR MANAGEMENT IN POTOMAC RIVER BASIN,
Washington Univ., Seattle. Dept. of Civil Engineering.
For primary bibliographic entry see Field 6A.
W83-00203

APPLICATION TO THE DES MOINES RIVER OF MULTIPLE RESERVOIR OPERATING STRATEGIES INCORPORATING SHORT-AND LONG-TERM INFORMATION IN REAL TIME,
Iowa Univ., Iowa City. Inst. of Hydraulic Research.
P. K. Kitanidis.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-108522, Price codes: A02 in paper copy, A01 in microfiche. IIHR Limited Distribution Report No 92, June 1982. 18 p, 5 Fig, 13 Ref. OWRT A-077-IA(1), 14-34-0001-1117.

Descriptors: *Reservoir operation, *Optimization, *Linear programming, *Stachastic hydrology, *Reservoirs, Operating policies, Optimum development plans, *Des Moines River, Systems analysis, Mathematical analysis, Statistical analysis, Stochastic process, Mathematical studies, Probabilistic process, Reservoir storage, Prediction, *Iowa.

Optimal reservoir operation is a complex and important problem. The problem of optimizing the operation of two Des Moines River, Iowa reservoirs (Saylorville and Red Rock), was segregated into four sub-problems for reservoir operation: during normal flow period, during minor and major floods, and under drought conditions. Each sub-problem reflects a different reservoir operation mode based on the hydrolic situation. Two particular problems were solved. The first dealt with the means for determining the optimum operation of Saylorville Reservoir under drought conditions, and illustrates the use of stochastic dynamic programming. The second problem was that of conjunctive operation of both re servoirs during a period of minor floods, and illustrates the use of Linear Quadratic Gaussian control in the operation of multi-reservoir systems, leading to linear release rules. The optimal daily release from each reservoir is given as a linear function of storages of both reservoirs and the preceeding-day flows, measured at various points of the river network. Opti mization of the Saylorville Reservoir under drought conditions used inflows represented through a cyclo-stationary (seasonal) Markov chain, and operational graphs were developed giving the optimal semi-monthly release as a function of reservoir storage at the beginning of the drought period. (Zielinski-MAXIMA)
W83-00248

ANALYSIS OF LEGAL AND INSTITUTIONAL ARRANGEMENTS AFFECTING WATER ALLOCATION AND USE IN NEBRASKA,
Nebraska Univ.-Lincoln. Coll. of Law.
For primary bibliographic entry see Field 6E.
W83-00250

HO: FOR REESE RIVER NATURAL RESOURCES OF THE TOIYABE-TOQUIMA HIGHLANDS, CENTRAL NEVADA,
Nevada Univ. System, Reno. Desert Research Inst.
For primary bibliographic entry see Field 6B.
W83-00253

PRODUCTION OF REPRODUCTIVELY LIMITED GRASS CARP FOR BIOLOGICAL CONTROL OF AQUATIC WEEDS - PHASE II,
Auburn Univ., AL. Dept. of Fisheries and Allied Aquacultures.
W. L. Shelton.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-108118, Price codes: A05 in paper copy, A01 in microfiche. Alabama Water Resources Research Institute WRRI Bulletin 45, Auburn University, Auburn, Ala., January, 1982. 64 p, 4 Fig, 7 Tab, 125 Ref. OWRT B-079-ALA(1), 14-34-0001-0201.

Descriptors: *Grass carp, *Aquatic weed control, *Sex reversal(Fish), *Fish populations, *Biological control, Fish food, Fish behavior, Carp, Aquatic weeds, Aquatic plants, Fish stocking, Fish physiology, Steroids, Methyltestosterone.

Use of the grass carp fish offers a useful mechanism for controlling the proliferation of nuisance aquatic plants infesting waterways, providing that unwanted reproduction of the grass carp itself could be controllable. Hence, a study was undertaken to develop a technique for producing grass carp populations with limited reproductive potential. Monosexing through hormone sex reversal was initially tried, but the specialized feeding habits of this fish complicated conventional oral treatment and necessitated an alternate method of steroid exposure. Silastic implantation containing methyltestosterone was the recommended method of hormone administration. Hence, functional sex reversal was used as a means of developing broodstock which, when bred, would yield monosex progeny. Sex-reversed males (genotypic females) were bred in 1980 and 1981; of about 500 offspring from the 1980 class that were sexed, all were females. Also, all gyno-genetic grass carp that were sexed have been females. Further evaluation of the 1980 class and sexing of 1981 class fish will be carried out. It is concluded that, if these offspring are also only female, this monosexing by breeding program can be considered for practical application for control of nuisance aquatic plant growth in waterways. (Zielinski-MAXIMA)
W83-00272

HIGH PLAINS - OGALLALA AQUIFER STUDY WATER TRANSFER ELEMENT,
Corps of Engineers, Dallas, TX. Southwestern Div.
W. R. Pearson.
In: Proceedings of the Twenty-Seventh Annual New Mexico Water Conference, Hope for the High Plains, April 1-2, 1982. WRRI Report No 145, May 1982. p 128-150, 3 Fig, 3 Tab, New Mexico Water Resources Research Institute, New Mexico State University, Las Cruces.

Descriptors: *Aquifers, *Water costs, *Water transfer, *Canals, *Environmental effects, Water distribution, Storage reservoirs, Water courses, Canal construction, Water loss, Pumping plants, Estimated costs, Total costs, Land use, *Ogallala Aquifer.

This paper presents findings on four alternatives, authorized by the High Plains Study Council, for transferring surplus water into the High Plains region from adjacent areas. The Corps of Engineers determined costs and environmental impacts for the four routes which are roughly identified as: Route A, Nebraska; Route B, Kansas; Route C, Oklahoma; Route D, Texas. The total first costs, including interest during construction, were calculated using 1977 prices, a 9-year authorization/design period, a 15-year construction period, and an interest rate of 7 3/8%. The initial study results indicate that, from an engineering standpoint, a canal system could be contructed to carry up to 9 million acre-feet of water from adjacent areas with first delivery costs ranging from $3.6 billion for 1.6 million acre-feet of water to Kansas, to $22.6 billion for 6 million acre-feet to the Texas/Oklahoma panhandle area. Annual cost, which include energy at current prices in 1977 dollars, range from $413 million for the Kansas route to $3.8 billion to transer 8.7 million acre-feet to Lubbock, Texas. The unit cost of water delivered to terminal storage in the aquifer goes from $226 ac/ft to $569 ac/ft in 1977 dollars. If energy costs increase as expected, the unit cost in 2105 would range from $320 to $880 ac/ft. Water losses of 10% have been assumed during transfer. Large amounts of energy would be needed to operate any of the systems, i.e., from 4 to nearly 50 billion killowat hours per year. Constructing any of these systems would also cause major environmental impacts. Water is available in adjacent areas, but only in-basin surpluses would be considered for export. (Atkins-Omniplan)
W83-00312

THE ECOLOGICAL EFFECTS OF 2-METHYLTHIOTRIAZINE HERBICIDES USED FOR AQUATIC WEED CONTROL IN NAVIGABLE CANALS, II. EFFECTS ON MACROINVERTEBRATE FAUNA, AND GENERAL DISCUSSION,
Liverpool Univ. (England) Dept. of Botany.
For primary bibliographic entry see Field 5C.
W83-00343

4B. Groundwater Management

THE OGALLALA--HALF FULL OR HALF EMPTY.,
For primary bibliographic entry see Field 6D.
W83-00017

CARROLL COUNTY GROUND-WATER INFORMATION: WELL RECORDS, SPRING RECORDS, AND CHEMICAL-QUALITY DATA.
Geological Survey, Towson, MD. Water Resources Div.
For primary bibliographic entry see Field 7C.
W83-00058

GEOHYDROLOGY OF SOUTHWESTERN KANSAS,
Geological Survey, Lawrence, KS. Water Resources Div.
For primary bibliographic entry see Field 7C.
W83-00059

THE HYDROTHERMAL SYSTEM IN SOUTHERN GRASS VALLEY, PERSHING COUNTY, NEVADA,
Geological Survey, Carson City, NV. Water Resources Div.; and Geological Survey, Menlo Park, CA. Water Resources Div.
A. H. Welch, M. L. Sorey, and F. H. Olmsted.
Available from the OFSS, USGS Box 25425, Fed. Ctr. Denver, CO 80225, Price: $28.50 in paper copy, $4.00 in microfiche. Open-File Report 81-915, 1981. 193 p, 35 Fig, 1 Plate, 18 Tab, 96 Ref.

Descriptors: *Hydrothermal studies, *Thermal water, *Aquifer characteristics, *Water temperature, Model studies, Structural geology, Hydrologic properties, Geochemistry, Geophysics, Thermal springs, Wells, Water level, Well data, Electric power, Maps, *Nevada, Pershing County, Southern Grass Valley.

Southern Grass Valley is typical extensional basin in the Basin and Range province. Leach Hot Springs, in the southern part of the valley, represents the discharge end of an active hydrothermal flow system with an estimated deep aquifer temperature of 163-173C. This report discusses results of geologic, hydrologic, geophysical and geochemical investigations used in an attempt to construct an internally consistent model of the system. (USGS)
W83-00060

EFFECTS OF EFFLUENT SPRAY IRRIGATION ON GROUND WATER AT A TEST SITE NEAR TARPON SPRINGS, FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
For primary bibliographic entry see Field 5B.
W83-00068

GEOHYDROLOGY OF THE VALLEY-FILL AQUIFER IN THE SOUTH FALLSBURGH-WOODBOURNE AREA, SULLIVAN COUNTY, NEW YORK,
Geological Survey, Albany, NY. Water Resources Div.; and New York State Geological Survey/State Museum, Albany.
For primary bibliographic entry see Field 7C.
W83-00069

APPROXIMATELY WATER-LEVEL CHANGES IN WELLS IN THE CHICOT AND EVANGELINE AQUIFERS 1977-82 AND 1981-82, AND MEASURED COMPACTION 1973-82, IN THE HOUSTON-GALVESTON REGION, TEXAS,

Geological Survey, Houston, TX. Water Resources Div.
For primary bibliographic entry see Field 7C.
W83-00075

WATER RESOURCES OF THE RINCON AND MESILLA VALLEYS AND ADJACENT AREAS, NEW MEXICO,
Geological Survey, Albuquerque, NM. Water Resources Div.
For primary bibliographic entry see Field 7C.
W83-00078

APPLICATIONS OF DIGITAL MODELING FOR EVALUATING THE GROUND-WATER RESOURCES OF THE '2,000-FOOT' SAND OF THE BATON ROUGE AREA, LOUISIANA,
Geological Survey, Baton Rouge, LA. Water Resources Div.
L. J. Torak, and C. D. Whiteman, Jr.
Louisiana Department of Transportation and Development, Baton Rouge, Water Resources Technical Report No 27, 1982. 87 p, 14 Fig, 8 Plates, 8 Tab, 5 Append.

Descriptors: *Computer models, *Groundwater, *Aquifers, *Potentiometric level, Forecasting, Aquifer characteristics, Groundwater movement, Leakage, Drawndown, Pumping, Groundwater availability, Hydrologic properties, Finite difference methods, Simulation analysis, *Louisiana, Baton Rouge.

Ground-water pumping at Baton Rouge, La., has lowered the potentiometric surface of the Miocene aquifer known as the '2,000-foot' sand about 430 feet, 1914-79. A three-dimensional, finite-difference, digital-computer model to simulate groundwater flow was developed as a management tool to evaluate effects of possible future variations in pumping on the potentiometric surface of the '2,000-foot' sand. Hydrogeologic factors included in the model are: spatial variations in hydraulic characteristics of the aquifers and confining layers; transient leakage from confining layers and leakage from other aquifers; and restriction of groundwater flow by the Baton Rouge fault. Preliminary models simulating ground-water flow in one, two, and three dimensions were used to evaluate these factors. A parameter-estimation program aided calibration of the model for the period 1914-61. Verification for the period 1962-79 did not require changes to parameter values. Simulations using possible future variations in pumpage indicate excessive drawdowns can be averted and relatively stable water levels can be achieved near Baton Rouge if pumpage is reduced about 10% from the 1979 rates. Outlying parts of the modeled area show continuing water-level declines, although pumpage was reduced by 30%. (USGS)
W83-00109

HYDROLOGIC DATA FOR THE ALLUVIUM AND TERRACE AQUIFER OF THE BEAVER-NORTH CANADIAN RIVER FROM THE PANHANDLE TO CANTON RESERVOIR, NORTHWESTERN OKLAHOMA,
Geological Survey, Oklahoma City, OK. Water Resources Div.
For primary bibliographic entry see Field 7C.
W83-00110

CHEMICAL AND ISOTOPIC COMPOSITION OF WATER FROM THERMAL AND MINERAL SPRINGS OF WASHINGTON,
Geological Survey, Menlo Park, CA. Water Resources Div.
For primary bibliographic entry see Field 2K.
W83-00112

DEEP ARTESIAN AQUIFERS OF SANIBEL AND CAPTIVA ISLANDS, LEE COUNTY, FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
D. H. Boggess, and T. H. O'Donnell.
Available from the OFSS, USGS Box 25425, Fed. Ctr. Denver, CO 80225, Price: $4.50 in paper copy, $3.50 in microfiche. Open-File Report 82-253, 1982. 32 p, 11 Fig, 4 Tab, 7 Ref.

Descriptors: *Groundwater, *Confined aquifers, *Water supply, *Water quality, Geohydrology, Aquifer characteristics, Wells, Water level, Pumping, Water management, Water use, Water properties, Saline water intrusion, Chemical analysis, *Florida, Sanibel Island, Captiva Island.

The principal sources of water on Sanibel and Captiva Islands, Lee County, Florida, are two deep artesian aquifers within the upper and lower parts of the Hawthorn Formation. Both aquifers are under artesian pressure and wells flow at the land surface. Water from the upper aquifer is of better quality than that from the lower aquifer and can be used in some areas without desalination. Dissolved solids concentrations in the upper aquifer average 1,540 milligrams per liter. Water levels in wells in the upper aquifer range from 8 to 15 feet above sea level; most wells flow as much as 15 gallons per minute at land surface. The lower aquifer is the source of the public supply for the islands. Dissolved solids concentrations in the lower aquifer range from 1,700 to 4,130 milligrams per liter and average 2,571 milligrams per liter. From July to November 1977, water levels in the aquifer ranged from 7 to 32 feet above sea level throughout Sanibel-Captiva Islands. In 1977 the average pumpage from public supply wells was 1.4 million gallons per day. Pumpage from the artesian aquifers during 1977 was about 690 million gallons. The water is desalinated before distribution. (USGS)
W83-00114

MAP SHOWING THE POTENTIOMETRIC SURFACE OF THE MAGOTHY AQUIFER IN SOUTHERN MARYLAND, SEPTEMBER 1981,
Geological Survey, Annapolis, MD. Water Resources Div.; and Geological Survey, Towson, MD. Water Resources Div.
For primary bibliographic entry see Field 7C.
W83-00115

GEOHYDROLOGY OF THE VALLEY-FILL AQUIFER IN THE SCHENECTADY AREA, SCHENECTADY COUNTY, NEW YORK,
Geological Survey, Albany, NY. Water Resources Div.
For primary bibliographic entry see Field 7C.
W83-00116

GEOHYDROLOGY OF THE VALLEY-FILL AQUIFER IN THE CORNING AREA, STEUBEN COUNTY, NEW YORK,
Geological Survey, Albany, NY. Water Resources Div.
For primary bibliographic entry see Field 7C.
W83-00117

SUMMARY APPRAISALS OF THE NATION'S GROUND-WATER RESOURCES--NEW ENGLAND REGION,
Geological Survey, Reston, VA. Water Resources Div.
A. Sinnott.
Available from Supt. of Documents, GPO, Washington, DC 20402, Price, $3.50. Professional Paper 813-T, 1982. 23 p, 8 Fig, 2 Tab, 111 Ref.

Descriptors: *Groundwater, *Regional analysis, *Streams, *Aquifer characteristics, Aquifer management, Water supply, Groundwater recharge, Groundwater availability, Wells, Water quality, Contamination, Water resources development, Groundwater potential, Coastal Plains, *New England Region.

The New England Region has a total area of about 62,400 square miles, and includes the States of Maine, New Hampshire, eastern Vermont, most of Massachusetts and Connecticut, all of Rhode Island, and a small part of southeastern New York. The longest stream is the Connecticut River, extending from northern Vermont and New Hampshire southward to Long Island Sound. Ground water in the region occurs in two types of geologic materials: unconsolidated sedimentary rocks, and consolidated rocks. The most productive unconsolidated sedimentary rocks are sand and gravel of glacial origin. These deposits occur all over Cape Cod and nearby islands in southeastern Massachusetts and in many of the valleys in the region. The consolidated rocks underlie the entire region. They include crystalline igneous and metamorphic rocks, and consolidated sedimentary rocks--shale, sandstone, and limestone and other carbonate rocks. Ground water is derived primarily from precipitation. It can be intercepted for use by pumping from wells (1) before it discharges to the streams as base flow, and (2) before it drains directly into coastal wetlands, bays, Long Island Sound or the ocean. The potential perennial yield of all the aquifers in the region is estimated to be 27.2 billion gallons per day; in addition, at least 105 trillion gallons is estimated to be stored in the aquifers. Withdrawals of fresh ground water in 1975 aggregated about 220 billion gallons, or about 12% of the total freshwater withdrawals of 1,800 billion gallons. In view of the available ground-water reserves, considerable additional water could be developed. (USGS)
W83-00120

DESIGNATION OF PRINCIPAL WATER-SUPPLY AQUIFERS IN MINNESOTA,
Geological Survey, St. Paul, MN. Water Resources Div.
For primary bibliographic entry see Field 2F.
W83-00125

ESTIMATED EFFECTS OF PROJECTED GROUND-WATER WITH-DRAWALS ON MOVEMENT OF THE SALTWATER FRONT IN THE FLORIDAN AQUIFER, 1976-2000, WEST-CENTRAL FLORIDA,
Geological Survey, Lakewood, CO. Water Resources Div.
W. E. Wilson.
Available from Supt. of Documents, GPO, Washington, DC 20402, Price, $3.75. Water-Supply Paper 2189, 1982. 24 p, 17 Fig, 2 Tab, 19 Ref.

Descriptors: *Computer models, *Groundwater, *Saline-freshwater interfaces, *Aquifer characteristics, Drawdown, Potentiometric level, Observation wells, Water level fluctuations, Pumping, Groundwater movement, Water use, Water quality, Phosphates, Mining, Chlorides, Simulation analysis, *Florida, West-central Florida, Floridan aquifer.

Maps of observed 1976 and simulated 2000 potentiometric surfaces were used to estimate rates of saltwater encroachment and theoretical equilibrium positions of the saltwater-freshwater interface in west-central Florida. The observed 19,000 milligram-per-liter isochlor corresponds closely to a theoretical saltwater-freshwater interface computed by the Ghyben-Herzberg method using heads from a map of the predevelopment potentiometric surface. Average landward flow rate of the saltwater front was computed to be between 0.30 and 0.36 foot per day during the simulation period. Seward potentiometric gradient under simulated October 2000 conditions averaged 8.8 x 0.00005 foot per foot less than under observed September 1976 conditions. Regional observation wells are desirable for monitoring potentiometric-level changes in western Hardee County and eastern Manatee County and for monitoring water-quality changes along the saltwater front. Net landward movement of the saltwater front in the lower part of the Floridan aquifer is probably occurring under existing conditions. Pumping during 1976-2000 would probably increase slightly the rate of movement. However, rates are so slow that, on a regional basis, saltwater encroachment is not a major threat to the freshwater resources. Significant local encroachment could result under certain conditions. (USGS)
W83-00130

TRACING WELL WATER POLLUTION IN A LIMESTONE AQUIFER,
Engineering Technology, Inc., New Orleans, LA.
For primary bibliographic entry see Field 5B.
W83-00173

USE OF FRACTURE TRACES IN WATER WELL LOCATION: A HANDBOOK.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-108274, Price codes: A04 in paper copy, A01 in microfiche. Office of Water Research and Technology, Washington, D.C., Report OWRT TT/82 1, April 1982. 55 p, 10 Fig, 19 Ref. OWRT C-00016-W (0444)(2).

Descriptors: *Geologic fractures, *Groundwater availability, *Site selection, *Well water, *Fracture springs, Contamination, Wells, Soil water, Groundwater, Available water, Fracture permeability, Fault springs, Subsurface water, Subsurface drainage, Surface permeability, Remote sensing, Geohydrology.

Fractures and faults often have subtle surface expressions that reveal their presence; based on this principle, competent well drillers/hydrogeologists/engineers have access to a scientifically-sound indirect means of locating the best spot to drill a successful well. The proper use of this technique, known as fracture trace analysis (FTA) is explained. The technique relies primarily on the use of aerial photographs to delineate the presence of subsurface fractures which may serve as conduits for groundwater flow. Covered are: basic groundwater hydrology; fundamentals of air photo interpretation; field application of fracture traces to water-well location; and the rating of drilling targets. Also considered are factors related to coordination with drilling contractors and hydrogeologic considerations influencing well yields. The FTA procedure sequence involves: assembling topographic/geologic/property maps and available area hydrogeologic data; locating aerial photographs (1:20,000 scale preferred); properly mapping all photolinear features in/adjacent to the area of interest; eliminating all obvious non-geologic linear features; establishing scale and true north direction on the photo; field-checking the photolinear features; and measuring/surveying accurately to the selected point for test/drilling. Specific examples of actual field application of the FTA technique. (Zielinski-MAXIMA)
W83-00217

GROUNDWATER IS THE ANSWER TO ZAMBIA'S WATER PROBLEM,
Johnson Screens Europe Office, London (England).
G. W. Burton.
Water Services, Vol 86, No 1035, p 222, May, 1982. 1 Fig.

Descriptors: *Groundwater mining, *Boreholes, *Water resources development, Groundwater, Pumping tests, Transmissivity, Specific capacity, Potable water, *Zambia, Africa.

The feasibility of groundwater extraction was investigated in a multiple-storey aquifer system in Zambia, south-eastern Africa. Borehole Peggy was drilled and sixteen hours of development were carried out using the jetting machine technique. Totally sand-free water was obtained after only two hours of airlifting. Test pump data yielded transmissivity estimate of 100 m2/d, specific capacity estimate of 73 m3/d/m, and radius of influence estimate of 300 m. A conservative production level was estimated to be 19.1 liters/s with a corresponding drawdown of 22.5 m. The borehole results indicated significant resources of potable water in the Mongu area. (Small-FRC)
W83-00225

GROUNDWATER IN THE INNER BLUEGRASS KARST REGION, KENTUCKY,
Kentucky Water Resources Research Inst., Lexington.
For primary bibliographic entry see Field 2F.
W83-00275

IRRIGATION SCHEDULING,
Nebraska Univ., Lincoln. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 3F.
W83-00310

4C. Effects On Water Of Man's Non-Water Activities

THE RECENT HISTORIES OF THREE CANADIAN SHIELD LAKES: A PALEOLIMNOLOGICAL EXPERIMENT,
Queen's Univ., Kingston (Ontario). Dept. of Biology.
For primary bibliographic entry see Field 5C.
W83-00042

LOW FLOW OF STREAMS IN FAIRFAX COUNTY, VIRGINIA,
Geological Survey, Fairfax, VA. Water Resources Div.
E. H. Mohler, Jr., and G. F. Hagan.
Available from the OFSS, USGS Box 25425, Fed. Ctr. Denver, CO 80225, Price: $8.00 in paper copy, $4.00 in microfiche. Open-File Report 81-63, 1981. 30 p, 8 Fig, 1 Plate, 4 Tab, 14 Ref.

Descriptors: *Low flow, *Streams, *Frequency analysis, *Urbanization, Streamflow, Flow characteristics, Geology, Flow measurements, Maps, *Virginia, Fairfax County, Potomac River, Occoquan River.

The effect of geologic differences and urban development on low-flow characteristics of streams in Fairfax County, Va., are discussed. Tables of annual minimum 7-day average flow values for various recurrence intervals are presented for 5 long-term gaging stations and for 37 selected low-flow measurement sites. Drainage-basin boundaries and 7-day 10-year low-flow values are shown on a 1:48,000-scale map of the county. (USGS)
W83-00062

HYDROLOGIC DATA FOR URBAN STORM RUNOFF FROM NINE SITES IN THE DENVER METROPOLITAN AREA, COLORADO,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 7C.
W83-00077

USE OF MATHEMATICAL MODELS TO PREDICT IMPACTS OF MINING ENERGY MINERALS ON THE HYDROLOGIC SYSTEM IN NORTHWESTERN COLORADO,
TRW, Lakewood, Colorado, Energy Engineering Division.
G. J. Saulnier, Jr., and K. E. Goddard.
Mining Engineering, Vol 34, No 3, p 285-293, March, 1982. 11 Fig, 1 Tab, 14 Ref.

Descriptors: *Hydrologic models, *Hydrologic systems, Coal mining, Oil shale, Mathematical models, Simulation analysis, Water quality, Groundwater, Geohydrology, Surface water, Prediction, *Colorado, *Mining industry.

Increasing development of coal and oil shale resources in northwestern Colorado has focused attention on the potential impacts of such development on the surface and subsurface hydrology of the affected areas. The U.S. Geological Survey has developed mathematical models programmed for digital computers to assess these potential impacts. A quasi-three-dimensional, finite-difference model has been used to simulate the potential impacts of oil shale mining on groundwater hydrology and of hypothetical mine dewatering operations at proposed oil shale mines. A true three-dimensional, solute-transport model was also used to evaluate the effects of flooding in hypothetical abandoned mines. A digital watershed model was used to investigate the potential impacts of coal and oil shale mining on watersheds having snow as the major source of runoff and recharge. A river quality assessment model was used to evaluate the potential impacts of coal development on surface water quality. Application of the models to the Piceance Creek basin in Colorado showed that dewatering operations during development would reduce the discharge in the Creek, that flooding of abandoned mines would impact negatively on both ground and surface water in the basin, and that most Colorado water quality goals would be met until 1985, although the standards for nonionized ammonia would be exceeded. These models represent an important first step in analyzing the existing data base and predicting impacts and in identifying new data needs. Although the models may not be totally applicable on the local level, they are very meaningful at a regional level. (Carroll-FRC)
W83-00168

DRAINAGE AND STRUCTURES.
For primary bibliographic entry see Field 8A.
W83-00334

4D. Watershed Protection

SOIL SURVEY OF THE EXPERIMENTAL CATCHMENTS NEAR BETHLEHEM,
Department of Water Affairs, Pretoria (South Africa). Hydrological Research Inst., Pretoria (South Africa).
H. Maaren.
Technical Report No. TR 96, May 1979. 30 p, 9 Fig, 11 Tab, 6 Ref, 4 Append.

Descriptors: *Catchment basins, *Soil surveys, *Soil classification, *Hydrologic aspects, Catchment areas, Watersheds, Hydrological regime, Hydrologic models, Eutrophication, Saline soils, Soil tests, Soil types, Soil moisture, Topsoil, Subsoil, Chemical analysis, Trace metals, Water analysis, Soil environment, Agricultural watersheds, *South Africa.

A 1979 soil survey of a 380 sq km catchment was carried out to provide a physically sound basis for studying catchment hydrology. Emphasis was placed on the influence of the soil environment and agricultural land use, while the significance of downslope lateral soil moisture movement and the concept of a variable source were also considered. Field studies were made in which 568 auger observations were taken. Characteristics examined included: geology/topography, vegetation and land use, climatic aspects, soil classifications, and soil effects on catchment hydrology. The catchment topsoil is predominantly orthic with some vertic, whill 11 diagnostic horizons occur in the subsoil horizons. Most of the soils are eutrophic. Observations indicated that lateral movement of soil moisture may be expected to perform a significant role in catchment hydrology. Moisture content in soil cores ranged from 11.6-16.1 weight-%. Ancillary trace metal analyses of river and farm seepage samples showed high total salt levels and a medium-high sodium adsorption ratio. Detailed observations are reported concerning soil types. The study results should provide an improved quantitative description of the hydrology of this natural catchment and assist catchment modeling efforts. (Zielinski-MAXIMA)
W83-00087

HYDROLOGIC DATA FOR EXPERIMENTAL AGRICULTURAL WATERSHEDS IN THE UNITED STATES, 1973,
Agricultural Research Center, Beltsville, MD. Hydrologic Data Lab.
For primary bibliographic entry see Field 7C.
W83-00095

RELATION OF USLE FACTORS TO EROSION ON RANGELAND,
Purdue Univ., Lafayette, IN. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 2J.
W83-00096

USE OF EROSION MODELS ON WESTERN RANGELANDS,
Bureau of Land Management, Boise, ID.
For primary bibliographic entry see Field 2J.
W83-00097

THE USLE RAINFALL FACTOR FOR SOUTHWESTERN U. S. RANGELANDS,
Science and Education Administration, Tucson, AZ. Southwest Rangeland Watershed Research Center.
J. R. Simanton, and K. G. Renard.
In: Proceedings of the Workshop on Estimating Erosion and Sediment Yield on Rangelands, Tucson, Arizona, March 7-9, 1981, Agricultural Reviews and Manuals ARM-W-26, June 1982, p 50-62, 11 Fig, 3 Tab, 10 Ref.

Descriptors: *Rainfall, *Soil erosion, *Rangeland, *Thunderstorms, *Erosion index, *Rainfall intensity, *New Mexico, *Arizona, Rainfall impact, Rainfall distribution, Kinetic energy.

Air-mass thunderstorms, occurring primarily during the summer months of July through September, dominate the rainfall/runoff/erosion relationships in much of the rangeland areas of the Southwest. To estimate the erosion associated with such areas, the Universal Soil Loss Equation (USLE) is being used to reflect the climatic variability and the potential erosion due to raindrop impact. The air-mass thunderstorms in the region are typically highly variable in both time and space, of limited areal extent, and of short duration. Data from the experimental watersheds at Safford, Arizona; Albuquerque, New Mexico; Walnut Gulch, Arizona; and Alamogordo Creek, New Mexico were used to compute the rainfall erosion index (product of the kinetic energy and 30-min maximum intensity) to illustrate the extreme temporal and spatial variability of the USLE rainfall erosion index (EI). Rainfall records from a single recording raingage can be used to estimate the EI only for the area within 0.3 mi radius of that point. Because EI computation is based on maximum 30-min rainfall intensity, most of the EI units are derived from the relatively short, high-intensity portion of the thunderstorms. Thus, in thunderstorm dominated rainfall areas such as Arizona and New Mexico, recording raingages with depths for short time intervals are needed to compute storm EI. An EI predicting equation that is based on widely available precipitation frequencies was developed for the thunderstorm-dominated regions of Arizona and New Mexico. This equation might also be used in other regions where thunderstorm rainfall dominates the hydrologic and erosion processes. (Moore-SRC)
W83-00098

EFFECTS OF SLOPE LENGTH AND STEEPNESS ON SOIL EROSION FROM RANGELANDS,
Washington State Univ., Pullman.
For primary bibliographic entry see Field 2J.
W83-00099

SPECIAL PROBLEMS IN THE APPLICATION OF THE USLE TO RANGELANDS: C AND P FACTORS,
Purdue Univ., Lafayette, IN. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 2J.
W83-00100

A TEST OF THE USLE ON BARE AND SAGEBRUSH PLOTS IN UTAH,
Utah State Univ., Logan. Watershed Science Unit.
G. E. Hart.
In: Proceedings of the Workshop on Estimating Erosion and Sediment Yield on Rangelands, Tucson, Arizona, March 7-9, 1981, Agricultural Reviews and Manuals ARM-W-26, June 1982, p 101-105, 2 Tab.

Descriptors: *Rangelands, *Soil erosion, *Rainfall intensity, Mathematical models, *Utah, Slopes, Rainfall simulators, Soil properties, Soil water, Vegetation.

In June, 1980 a rainfall simulator was used on eight standard plots (72.6 x 6 feet) to evaluate factors in the Universal Soil Loss Equation (USLE) on rangelands. Two conditions were examined: low intensity rainfall (about 1.1 in/hr for 60 minutes) on dry soil followed by high intensity rainfall (about 2.2 in/hr for 33 minutes) on very wet soil. The study area is situated about 20 miles northeast of Logan, Utah at an elevation of 6200 feet. The soil is a silt loam, typic argixeroll, a common soil in mountains of northern Utah, and a K value of .32 was assigned from the nomograph using particle-sizes from lab analysis. Four plots were on a gentle slope (11%), and four were on a 32% slope about 100 yards away. Three surface conditions existed on the plots, both on gentle and steep sites: fallow, crusted, and vegetated. Closer prediction of measured soil loss occurred for higher intensity rainfall on previously wetted bare soil than for lower intensity rain on very dry soil. Effects of antecedent moisture can be important and are not taken into account for individual events. Existing tables, or methods, for determining K values and C values (particularly C values in the bare, fallow condition) do not adequately represent wildland soils and cover. The substantial overestimates by the USLE seem mostly attributed to these factors. A major research need is to establish baseline values of soil losses per unit of R under standard conditions of a bare, but uncultivated, surface. (Moore-SRC)
W83-00101

USE OF RAINFALL SIMULATORS TO DETERMINE PARAMETERS FOR EROSION PREDICTION,
Science and Education Administration, Ames, IA.
For primary bibliographic entry see Field 2J.
W83-00102

ESTIMATING SEDIMENT YIELD FROM RANGELAND WITH CREAMS,
Purdue Univ., Lafayette, IN. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 2J.
W83-00103

MODELING EROSION IN OVERLAND FLOW,
Science and Education Administration, Tucson, AZ. Southwest Rangeland Watershed Research Center.
L. J. Lane, and E. D. Shirley.
In: Proceedings of the Workshop on Estimating Erosion and Sediment Yield on Rangelands, Tucson, Arizona, March 7-9, 1981, Agricultural Reviews and Manuals ARM-W-26, June 1982, p 120-128, 1 Fig, 2 Tab, 17 Ref.

Descriptors: *Overland flow, *Soil erosion, *Mathematical models, *Rainfall-runoff relationships, Rill erosion, Rainfall impact, Rainfall simulators, Model studies, Sediment yield, Small watersheds, Arizona.

Runoff from upland areas can be accompanied by substantial erosion. Overland flow on upland areas was modeled as overland flow on a plane. Erosion on upland areas is conceptualized as consisting of rill and interrill erosion. Interrill erosion is assumed due to rainfall impact, and rill erosion was defined as erosion due to tractive forces and transport capacity in flow as it occurs in rills or small channels. The combined runoff-erosion process is called overland flow with rill and interrill erosion. Partial differential equations have been formulated for the above runoff-erosion process. Analytic solutions were developed for the general case of rising, equilibrium, and recession hydrographs and for the entire partial-equilibrium hydrograph. The runoff-erosion model was tested using rainfall simulator data. Optimal values of the model parameters were determined for 9 runoff events. Simulation results with the optimal parameters seem to be reasonable approximations (good fit) to observed runoff and concentration data. Sediment yield values computed by the model also seem to be reasonable approximations to observed data. To determine if the coupled runoff-erosion equations might have applications for natural watersheds, data from a small, natural watershed on Walnut Gulch were analyzed. The computed sediment concentration and sediment yield data were consistent with observations on this watershed. The parameter values were logically related to parameters from the experimental plots, and thus, the procedure may have application to small watersheds. (Moore-SRC)
W83-00104

SEDIMENT YIELD FROM SMALL SEMIARID RANGELAND WATERSHEDS,
Science and Education Administration, Tucson, AZ.
K. G. Renard, and J. J. Stone.
In: Proceeding of the Workshop on Estimating Erosion and Sediment Yield on Rangelands, Tucson, Arizona, March 7-9, 1981, Agricultural Reviews and Manuals ARM-W-26, June 1982, p 129-144, 3 Fig, 6 Tab, 24 Ref.

Descriptors: transport, Runoff, Hydrologic models, Range management, *Arizona, Experimental watersheds.

Predicting sediment yield in the western United States, despite recent developments in water resource models, is difficult and often subjective. Five sediment yield formulas were tested with sediment yield data from nine small watersheds in the Walnut Gulch Experimental Watershed near Tombstone, Arizona. The methods tested include: the Pacific Southwest Interagency Committee Method (PSIAC), the Dendy/Bolton Method, the Flaxman Method, the Renard Method, and Simulator for Water Resources in Rural Basins (SWRRB) Modified Universal Soil Loss Equation (MUSLE). The PSIAC method appears to give the best results for the amount of work required to make the estimate. The SWRRB/MUSLE method also gave good results, but the amount of work required for the hydrologic portion of the model is considerable. Only the PSIAC and the SWRRB/MUSLE methods allow the use of factors (parameters) that reflect management practices. The Renard method also could be used to reflect management practices if the stochastic runoff model and the sediment transport relationship were used directly. The Flaxman method, as modified in 1974, illustrates some of the improvement which can be obtained by inclusion of an additional term to reflect the 2-yr frequency peak flow. The methods tested generally underpredicted sediment yield. The underprediction may, in part, be associated with the questionable representativeness of the climatic sample for the period of observation. (Moore-SRC)
W83-00105

PREDICTING SEDIMENT YIELDS FROM SAGEBRUSH RANGELANDS,
Science and Education Administration, Boise, ID. Northwest Watershed Research Center.
C. W. Johnson, and K. A. Gebhardt.
In: Proceedings of the Workshop on Estimating Erosion and Sediment Yield on Rangelands, Tucson, Arizona, March 7-9, 1981, Agricultural Reviews and Manuals ARM-W-26, June 1982, p 145-156, 5 Fig, 5 Tab, 13 Ref.

Descriptors: *Sediment yield, *Rangeland, *Mathematical models, *Grazing, *Sagebrush, *Idaho, Rangemanagement, Environmental Impact Statement, Vegetation, Brush control, Herbicides.

Comparative analysis is a common technique in Environmental Impact Statement preparation, because it shows the effects of alternative action in relation to present conditions or some recognized standard. Generally, there is a lack of on-site field data and, because of the large expense required for information collection, appropriate methods and data must often be extrapolated to the area under consideration. This study shows an application of the Pacific Southwest Inter-Agency Committee (1968) sediment yield prediction procedure (PSIAC) compared with measured yields from sagebrush rangeland areas in southwest Idaho. Predicted yields were within 15% of measured watershed sediment yields and provide a method for comparing and predicting effects of different site conditions and management changes. The equations developed to evaluate individual PSIAC factors are an improvement over subjective narrative method used in the original procedure. Average yearly predicted sediment yields from three Reynolds Creek watersheds by the PSIAC procedure ranged from 1.3 to 2.1 t/ha/yr. Predicted yields on

watershed subareas ranged from 1.0 to 2.7 t/ha/yr in response to PSIAC factor values. Moderate to heavy cattle grazing increased PSIAC estimated sediment yield about 0.2 t/ha/yr, based on differences in vegetative cover on grazed areas and areas that had been ungrazed about 8 years. Extremely heavy cattle grazing increased PSIAC estimated sediment yield 0.32 t/ha/yr. PSIAC estimated sediment yield was only increased about 0.1 t/ha/yr where sagebrush was cut and removed. Sagebrush eradication by spraying had less effect on sediment yield than moderate-to-heavy grazing. (Moore-SRC)
W83-00106

TESTING THE MODIFIED UNIVERSAL SOIL LOSS EQUATION,
Agricultural Research Service, Temple, TX.
J. R. Williams.
In: Proceedings of the Workshop on Estimating Erosion and Sediment Yield on Rangelands, Tucson, Arizona, March 7-9, 1981, Agricultural Reviews and Manuals ARM-W-26, June 1982, p 157-165, 4 Tab, 12 Ref.

Descriptors: *Soil erosion, *Runoff rates, *Mathematical models, *Runoff volume, Erosion control, Storm runoff, Hydrologic models, Slopes, Climate, *Watershed management.

The Modified Universal Soil Loss Equation (MUSLE) was developed by replacing the rainfall energy factor of the USLE with a runoff energy factor. The MUSLE runoff energy factor is a function of the product of the runoff volume and the peak runoff rate for an individual storm. The MUSLE was tested with data from 102 watersheds located throughout the U.S. These watersheds provided a wide range in watershed and climatic characteristics and management strategies. In tests using measured runoff data, MUSLE generally gave satisfactory results, but two possible deficiencies were discovered: the LS (slope length and steepness) factor may not be adequate for flat slope watersheds; and there may be a tendency for MUSLE to overpredict small storms and underpredict large ones. The runoff energy and erosion control practice factors need attention. MUSLE was linked with an expanded version of the CREAMS daily rainfall hydrology model to provide estimates of the runoff factor. The new hydrology-sedimentation model called SWRRB (Simulator for Water Resources on Rural Basins) shows promising results although some of the tests are not complete. (Moore-SRC)
W83-00107

DEVELOPING A USLE COVER-MANAGEMENT (C) FACTOR PROCEDURE FOR FOREST CONDITIONS,
Forest Service, Atlanta, GA.
G. E. Dissmeyer.
In: Proceedings of the Workshop on Estimating Erosion and Sediment Yield on Rangelands, Tucson, Arizona, March 7-9, 1981, Agricultural Reviews and Manuals ARM-W-26, June 1982, p 166-186, 11 Fig, 3 Tab, 13 Ref.

Descriptors: *Soil erosions, *Forest management, *Mathematical models, *Clear-cutting, Canopy, Roots, Ground cover, Storage, Sheet erosion, Rill erosion, Contour tillage, Soil organic matter, Mississippi, Tennessee, North Carolina, South Carolina.

The major subfactors operating in the forest environment are: amount of bare soil, or conversely, ground cover; canopy; soil reconsolidation; high organic content; fine roots; residual binding effect; on-site storage; steps; and contour tillage. A value for the composite C factor is a product of values for each of the subfactors operating in a given forest situation. The procedure for determining the C factor was tested using data from forest research watersheds in northern Mississippi, western Tennessee and North Carolina, and research plots in South Carolina. The forest management conditions included undisturbed, clear-cut, strip cut forest and a variety of site preparation treatments including bedding, chopping, disking, shearing and windrowing, and shearing, windrowing, and seeding with grass. Results of the validation suggested that the procedure gives reasonable values for the Universal Soil Loss Equation (USLE) factor C for forest conditions. This procedure incorporates many of the factors that affect sheet and rill erosion on forest land and provides a means for evaluating C for a broad range of condition that could not be accomplished with a classification system. (Moore-SRC)
W83-00108

LARGE-SCALE BEDFORMS IN THE PLATTE RIVER DOWNSTREAM FROM GRAND ISLAND, NEBRASKA: STRUCTURE PROCESS, AND RELATIONSHIP TO CHANNEL NARROWING,
Geological Survey, Denver, CO. Water Resources Div.
K. D. Crowley.
Open-File Report 81-1059, 1981. 33 p, 15 Fig, 20 Ref.

Descriptors: *Rivers, *Braided streams, *Channels, *Sedimentary structures, Channel morphology, Sediment transport, Flow characteristics, Vegetation effects, *Nebraska, Platte River, Bed forms.

The Platte River channel in Nebraska, especially downstream from Grand Island, is characterized by large, periodic, and geometrically distinct bedforms called macroforms. Macroforms have dimensions commensurate with the width and depth of the channel and are emergent at all but the highest flow stages. The encroachment of vegetation on macroforms and their consequent stabilization since the large-scale development of irrigation in the Platte River basin is the major cause of the reduction in channel width upstream from Grand Island. From simple geometrical considerations of macroform shape, an equation is developed to predict the depth and duration of flow required to erode the stoss sides of the macroforms to remove new vegetal growth each year. The methods developed in this report to eliminate vegetal growth on macroforms may provide a useful management tool for controlling width of the Platte River channels. Although further testing is required to establish the validity of these methods at actual stream sites, a sample calculation for the Silver Creek reach shows good agreement between the flow conditions predicted by the methods developed in this report and actual flow conditions. (USGS)
W83-00111

PERENNIAL-STREAMFLOW CHARACTERISTICS RELATED TO CHANNEL GEOMETRY AND SEDIMENT IN MISSOURI RIVER BASIN,
Geological Survey, Lawrence, KS. Water Resources Div.
W. R. Osterkamp, and E. R. Hedman.
Available from Supt. of Documents, GPO, Washington, DC 20402, Price, $4.75. Professional Paper 1242, 1982. 37 p, 12 Fig, 10 Tab, 42 Ref.

Descriptors: *Sediments, *Channel morphology, *Streamflow, *Flow characteristics, Perennial streams, Sediment transport, Data collections, Gaging stations, *Missouri River basin, Channel geometry, Width-discharge relations.

Geometry, channel-sediment, and discharge data were collected and compiled from 252 streamflow-gaging stations in the Missouri River basin. The sites represent the complete ranges of hydrologic and geologic conditions found in the basin. The data were analyzed by computer to yield equations relating various discharge characteristics to variables of channel geometry and bed and bank material. The equations provide discharge as the dependent variable for the purpose of making estimates of discharge characteristics at ungaged sites. Results show that channel width is best related to variables of discharge, but that reduction of standard errors can be achieved by considering channel-sediment properties, channel gradient, and discharge variability. The channel-material variables do not exert uniform effects on width-discharge relations and, therefore, are considered as sediment-data groups, or stream types, rather than as terms in multiple power-function equations. Relative to streamflow, narrowest channels occur when streams of steady discharge transport sufficient silt and clay to form stable, cohesive banks but have a small tractive load of sand and coarser sizes. Stable channels also are associated with high channel gradients, which cause high channel roughness and bed and bank armouring by coarse particle sizes. The widest, most unstable channels are found with streams that apparently transport of large tractive load of sand sizes. The downstream rates of change of width with discharge reflect these trends, suggesting that a given bed-material load necessitates a minimum width over which the tractive material can be moved. (USGS)
W83-00121

THE SPATIAL DISTRIBUTION IN SOUTHERN AFRICA OF RAINFALL EROSIVITY FOR USE IN THE UNIVERSAL SOIL LOSS EQUATION,
Department of Agriculture and Fisheries, Pietermaritzburg (South Africa).
For primary bibliographic entry see Field 2J.
W83-00140

SOIL CHARACTERIZATION AND ALTERNATE SHORELINE EROSION CONTROL MEASURES FOR CONSTRUCTED LAKES IN IOWA,
Iowa State Univ., Ames. Dept. of Civil Engineering.
R. A. Lohnes, and B. M. Berg.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-108282, Price codes: A04 in paper copy, A01 in microfiche. Completion Report, October 1981. 42 p, 14 Fig, 10 Tab, 37 Ref, 1 Append. OWRT A-074-IA(1), 14-34-0001-0117.

Descriptors: *Soil classification, *Erosion control, *Mathematical models, *Lake shores, *Bank erosion, Shore production, Artificial lakes, *Iowa, Field tests, Soil physical properties, Model studies, Computer models, Design criteria, Shoreline cover, Predictions.

Field observations of eroded lake shoreline profiles and field and laboratory measurements of geotechnical properties of shoreline soils led to development of a shoreline erosion model. The model includes equations which can be used to estimate the potential maximum height of wave-cut cliff. Predictions obtained from the model were compared with measured values in the field, and were found to show reasonable agreement. This model may be the first stop for developing a design method whereby shorelines of artificial lakes can be graded to an equilibrium configuration, therby eliminating/minimizing erosion by wave action. While future field observations may require modification of the model, present observations indicate that active erosion is occurring at all three lake shoreline sites studied, and that these sites have not reached equilibrium. Soil characterizations included soil composition analysis (e.g., sand, clay, gravel, silt), dry weight, moisture, and shear strengths. Samples were taken from shorelines of two man-made lakes to compare/contrast shoreline erosion. The lakes examined were Big Creek Lake in Polk County and Prarie Rose Lake in Shelby County. (Zielinski-MAXIMA)
W83-00218

IIHR DISTRUBUTED PARAMETER WATERSHED MODEL,
Iowa Univ., Iowa City. Iowa Inst. of Hydraulic Research.
For primary bibliographic entry see Field 2E.
W83-00269

RUNOFF AND SEDIMENTATION POTENTIALS INFLUENCED BY LITTER AND SLOPE ON A CHAPARRAL COMMUNITY IN CENTRAL ARIZONA,
Arizona State Univ., Tempe. Div. of Agriculture Natural Resource Management.
J. H. Brock, and L. F. DeBano.
In: Proceedings of the Symposium on Dynamics and Management of Mediterranean-Type Ecosys-

tems, June 22-26, 1981, San Diego, California, Pacific Southwest Forest and Range Experiment Station General Technical Report PSW-58, 1982, p 372-377, 4 Fig, 3 Tab, 19 Ref. 16-882-CA.

Descriptors: *Chaparral, *Slopes, *Surface runoff, *Sedimentation, *Litter, Infiltration capacity, *Arizona, Soil erosion, Erosion control, Watersheds.

The chaparral type is an important watershed resource in Arizona where it covers about 3-1/2 million acres at mid-elevations throughout the central part of the state. Several factors affect the runoff-sedimentation relationships in chaparral, including vegetation cover and density, litter, slope, and the infiltration capacity of the soil. Runoff and sediment was measured for a chaparral community on the Prescott National Forest in the summer of 1979. The cover on the study area was composed mainly of shrub liveoak (Quercus turbinella) and Wright mountainmahogany (Cercocarpus breviflorus). Simulated rainfall intensities of 12.5 cm/hr were applied to steep, moderate, and gentle sloped plots covered with none, light, moderate and heavy litter. Infiltration capacity was highest (10.8 cm/hr) on heavy litter plots giving low runoff potentials. Highest sediments (1466 kg/ha) were from bare soils. Litter cover significantly reduced sediment losses and decreased runoff potentials. Even small amounts of litter on the surface greatly reduced the onsite erosion potential of these chaparral soils. Treatments in chaparral communities which bare the soil and leave it unprotected should be avoided. (Moore-SRC)
W83-00301

ROLE OF FUNGI IN POSTFIRE STABILIZATION OF CHAPARRAL ASH BEDS,
Pacific Southwest Forest and Range Experiment Station. Glendora, CA.
P. H. Dunn, W. G. Wells, II, J. Dickey, and P. M. Wohlgemuth.
In: Proceedings of the Symposium on Dynamics and Management of Mediterranean-Type Ecosystems, June 22-26, 1981, San Diego, California, Pacific Southwest Forest and Range Experiment Station General Technical Report PSW-58, 1982, p 378-381, 2 Tab, 12 Ref.

Descriptors: *Rain, *Fires, *Soil erosion, *Soil fungi, *Erosion control, Sediment control, Heat-shock fungi, Watershed management, Rainfall impact, Chaparral, *California.

Raindrop impact is a major agent of soil erosion, and any reduction in its effectiveness reduces sediment production from burned watersheds. One possible biological approach to reducing raindrop impact erosion is through the use of heat-shock soil fungi, a group indigenous to chaparral. The heat-shock fungi require a period of heating before their spores will germinate, yet the organisms are not thermophilic. The heat-shock fungi in ash bed are adapted to the high ammonium and pH conditions of the ash and are capable of very rapid growth rates. A chaparral soil treated with heat-shock fungi in three combinations was compared to sterile soil to test the ability of the fungi to diminish raindrop impact erosion after fires. Production of rain-splashed sediment was two to three times greater on the sterile soil than on any of the soils with fungi. The natural heat-shock flora reduced the amount of rain-splashed sediment by 40% over the sterile treatment. Enhancement with additional Aspergillus fishcheri var. glaber produced even greater reductions, 45% over the heat-shock fungi treatment and 65% over the sterile soil. (Moore-SRC)
W83-00302

ESTIMATING HYDROLOGIC VALUES FOR PLANNING WILDLAND FIRE PROTECTION,
For primary bibliographic entry see Field 6B.
W83-00306

5. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification Of Pollutants

DETERMINATION OF PYRAZON RESIDUES IN WATER BY REVERSED PHASE HIGH PERFORMANCE LIQUID CHROMATOGRAPHY,
Alberta Environmental Center, Vegreville.
I. Ahmad.
Journal of Environmental Science and Health, Part B, Vol 17, No 3, p 253-263, 1982. 3 Fig, 2 Tab, 10 Ref.

Descriptors: *High performance liquid chromatography, *Pyrazon, *Pollutant identification, *Chromatography, Separation techniques, Water analysis, Agricultural chemicals, Herbicides.

A reversed phase high performance liquid chromatography method for the quantitative determination of pyrazon residues in water is described. The simple method replaces the traditional liquid-liquid extraction technique by an adsorption-trapping procedure for the extraction of pyrazon. The method is simple and offers average recoveries of 98.1%. The herbicide is detected with ultraviolet at 270 nanometers. The new technique can be used on water samples containing pyrazon concentrations ranging from 2 ppb to 1 ppm. To demonstrate the use of the method a sample of Vermilion River water was taken from a location near St. Joseph's Hospital, Vegreville, Alberta. It was filtered through a 0.45 micron filter and spiked with pyrazon at 25 ppb. The spiked as well as unspiked samples were carried through the procedure. No pyrazon was found in the blank sample. The recovery of pyrazon from the spiked sample was 94.6%. The pyrazon peak occurred at 6.50 min. Other peaks were present in the sample due to some unknown impurities in water. (Geiger-FRC)
W83-00014

ADSORPTION OF PAH TO AQUATIC HUMUS,
Norwegian Inst. for Water Research, Oslo (Norway).
For primary bibliographic entry see Field 5B.
W83-00038

DIFFERENTIAL PULSE POLAROGRAPHY OF SOME HERBICIDES DERIVED FROM 2,4-DICHLOROPHENOXYACETIC ACID, II. DETERMINATION OF HERBICIDE RESIDUES IN IRRIGATION WATERS,
Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Chemie.
A. Lechien, P. Valenta, H. W. Nurnberg, and G. J. Patriarche.
Fresenius' Zeitschrift fuer Analytische Chemie, Vol 306, No 2-3, p 156-160, 1981. 8 Fig, 2 Tab, 11 Ref.

Descriptors: *Pollutant identification, *Herbicides, *Polarographic analysis, Pesticides, *Irrigation water, Water analysis, *Halogenated pesticides, Farm wastes, Separation techniques, *West Germany, *Polarography, Organic acids.

A technique was developed for the differential pulse polarographic analysis of 2,4-D, 2,4-DP, MCPA, and MCPP residues in irrigation waters. Acidified water samples were extracted into chloroform and back extracted into alkali solution. After a final extraction into chloroform, the residues were nitrated and the herbicide concentration was determined by differential pulse polarography. The detection limits were 30 micrograms/liter for 2,4-D and MCPA and 40 micrograms/liter for 2,4-DP and MCPP. Herbicide recoveries ranged from 94.7 to 100%. The present method may also be applied to the analysis of mixtures of 2,4-D and 2,4-DP and of MCPA and MCPP. The sensitivity of the differential pulse polarographic method compared favorably with that offered by other methods such as gas chromatography. (Geiger-FRC)
W83-00045

DETERMINATION OF ORGANOPHOSPHORUS AND ORGANOSULPHUR AT THE SUB-NG-LEVEL FOR USE IN WATER ANALYSIS,
Utrecht Rijksuniversiteit (Netherlands). Analytical Chemistry Lab.
L. M. Puijker, G. Veenendaal, H. M. J. Janssen, and B. Griepink.
Fresenius' Zeitschrift fuer Analytische Chemie, Vol 306, No 1, p 1-6, 1981. 5 Fig, 2 Tab, 7 Ref.

Descriptors: *Pollutant identification, *Phosphorus, *Sulfur, Phosphorus compounds, *Organic compounds, Nutrients, Water analysis, Sulfur compounds, Separation techniques, Flame photometry, Chromatorgraphy, Photometry, *Organophosphates, *Organosulfates.

A method is described for the determination of organophosphorus and organosulfur compounds in water. Organic compounds are separated from the aqueous sample either by adsorption on XAD resin followed by desorption with methanol or by direct extraction into an organic solvent. The organic solution which results is brought into the hot zone of a heated quartz tube and is flushed with hydrogen. Reaction products are collected in a cold trap which is afterwards heated to 150-200 C. PH3, H2S and other compounds are separated at room temperature on a chromatographic column. Phosphorus and sulfur are detected by flame photometry down to traces as low as 0.1 and 1 nanogram, respectively. The time for each determination, excluding the isolation procedure, was less than 30 min. (Geiger-FRC)
W83-00046

DETERMINATION OF BORON IN RIVER WATER WITH FLAMELESS ATOMIC ABSORPTION SPECTROMETRY (GRAPHITE FURNACE TECHNIQUE),
Rijksinstituut voor Drinkwatervoorziening, Leidschendam (Netherlands).
R. P. van der Geugten.
Fresenius' Zeitschrift fuer Analytische Chemie, Vol 306, No 1, p 13-14, 1981. 1 Fig, 1 Tab, 7 Ref.

Descriptors: *Pollutant identification, *Boron, *Cations, *Atomic absorption spectrophotometry, Calcium, Magnesium, Rivers, Water analysis, *Spectrophotometry, Photometry, Flame photometry.

A simple and rapid technique for the determination of boron (B) in river water by flameless atomic absorption spectrophotometry is presented. The water sample is acidified to pH 2 with nitric acid. To a 100 ml sample, 2 ml of magnesium/calcium solution (10 g/liter Mg, 5 g/liter Ca) is added before spectrophotometric analysis. B levels up to 250 micrograms/liter may be determined with a detection limit of 20 micrograms/liter. The limited working range of 250 micrograms/liter is probably the result of increased carbon-boron interactions at higher concentration levels, resulting in a low reproducibility of signals. The mean standard deviation is 6 + or - 4micrograms/liter. The effect of several other cations on the B signal is discussed. (Geiger-FRC)
W83-00047

AN APPRAISAL OF SURFACE-WATER QUALITY IN THE ALAMEDA CREEK BASIN, CALIFORNIA, OCTOBER 1974-JUNE 1979,
Geological Survey, Menlo Park, CA. Water Resources Div.
For primary bibliographic entry see Field 5B.
W83-00064

QUALITY OF SURFACE WATER AT SELECTED SITES IN THE SUWANNEE RIVER BASIN, FLORIDA, 1980,
Geological Survey, Tallahassee, FL. Water Resources Div.
For primary bibliographic entry see Field 7C.
W83-00113

Group 5A—Identification Of Pollutants

WATER-QUALITY CHARACTERISTICS OF SIX SMALL, SEMIARID WATERSHEDS IN THE GREEN RIVER COAL REGION OF COLORADO,
Geological Survey, Lakewood, CO. Water Resources Div.
J. T. Turk, and R. S. Parker.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-207390, Price codes: A06 in paper copy, A01 in microfiche. Water-Resources Investigations 81-19, 1982. 96 p, 6 Fig, 8 Tab, 10 Ref.

Descriptors: *Water quality, *Small watersheds, *Mineralogy, *Data collections, Statistical analysis, Trace metals, Streams, Geochemistry, Coals, Strip mine wastes, Baseline studies, Regional analysis, *Colorado, Green River coal region.

Analysis of major and trace constituents in streams flowing through six semiarid watersheds indicates that the stream chemistry is characterized by saturation with respect to common carbonate minerals (calcium, magnesium, iron, manganese, and lead). The solubility of the carbonate minerals may be a major control on the absolute and relative concentrations of calcium, magnesium, bicarbonate, iron, manganese, and lead; however, other mechanisms probably control the concentrations of cadmium and zinc. Statistical analyses indicate that the mean concentrations of the major ions in the two climatic areas studied are significantly (P=0.05) different from one another, with larger mean concentrations in the more arid area. Trace-metal concentrations were similar from one area to another and indistinguishable from site to site (P=0.05) for lead, cadmium, and zinc. Linear regressions of major ion concentration to specific conductance are similar in both areas for sodium, bicarbonate, sulfate, and chloride. Results of the study may be useful in providing a first approximation of stream chemistry in other watersheds with the same geologic setting, determining watersheds with similar geochemical controls, and determining future changes in stream chemistry in the watersheds studied. (USGS)
W83-00124

METHODS FOR COLLECTION AND ANALYSIS OF GEOPRESSURED GEOTHERMAL AND OIL FIELD WATERS,
Geological Survey, Menlo Park, CA. Water Resources Div.
For primary bibliographic entry see Field 2K.
W83-00127

WATER RESOURCES DATA FOR NEW YORK, WATER YEAR 1981--VOLUME 3. WESTERN NEW YORK.
Geological Survey, Albany, NY. Water Resources Div.
For primary bibliographic entry see Field 7C.
W83-00131

WATER RESOURCES DATA FOR NORTH CAROLINA, WATER YEAR 1981.
Geological Survey, Raleigh, NC. Water Resources Div.
For primary bibliographic entry see Field 7C.
W83-00132

CHEMICAL SURVEILLANCE OF RIVERS,
Severn-Trent Water Authority, Birmingham (England). Directorate of Scientific Services.
J. S. Fenlon, and D. D. Young.
Water Pollution Control, Vol 81, No 3, p 343-357, 1982. 5 Fig, 3 Tab, 7 Ref.

Descriptors: *Monitoring, *Rivers, *Sampling, Chemical analysis, Water quality, *Pollutant identification, Automation, Biological oxygen demand, Dissolved oxygen, Suspended solids, Ammonia, Severn-Trent Water Authority, *United Kingdom.

The development and the objectives of chemical surveillance of river water quality in the United Kingdom are reviewed. Little river water quality monitoring was carried out before 1950. Four national and 2 supplemental surveys were performed in 1958-1980. A successful sampling scheme must begin with well-defined objectives. Some of these include detection of pollution, identification of trends, assessment of compliance with statutory requirements, and information for decisions. Choice of substances to be monitored depends on the objectives and legal requirements. Most common are BOD, suspended solids, ammonia, dissolved oxygen, pH, temperature, total organic nitrogen, chloride, hardness, and electric conductivity. Manual monitoring provides a wide spectrum of analyses at infrequent intervals; intrumental monitoring provides a continuous record for a few determinants, not including BOD. The Severn-Trent Water Authority sampling program is described. (Cassar-FRC)
W83-00134

SEASONAL CHANGES OF DISSOLVED SODIUM IN THE CONNECTICUT RIVER NEAR NORTHFIELD, MASSACHUSETTS,
Massachusetts Univ., Amherst. School of Health Sciences.
For primary bibliographic entry see Field 5B.
W83-00139

BIOASSAY TECHNIQUE FOR RELATIVE TOXICITY IN WATER POLLUTION CONTROL,
Texas Univ. at Dallas.
A. W. Busch.
Journal of the Water Pollution Control Federation, Vol 54, No 7, p 1152-1154, July, 1982. 4 Fig, 12 Ref.

Descriptors: *Pollutant identification, *Biological oxygen demand, *Toxicity, *Bioassay, Water pollution effects, Bacteria, Copper, Cyanides, Detergents, Water pollution control.

The BOD bottle bacterial test system is reintroduced as a method for determining relative toxicity of low concentrations of substances or effluents. By establishing benchmark responses for known toxicants such as copper, cyanide, and cadmium, in parallel, simultaneous tests, the relative toxicity of the test substance may be assessed. Although this technique needs further refinement, it deserves reevaluation because it is simple and direct, the bacteria are ubiquitous and easy to control, respiration and assimilation can be studied, both acute and chronic toxicity may be assessed, and capital costs are low. Examples of the procedure's use in determining toxicity of copper, cyanide, and alkyl benzene sulfonates are given. (Cassar-FRC)
W83-00146

MULTIPLE PURGE TECHNIQUES FOR DETERMINING ORGANIC POLLUTANTS IN GROUNDWATER,
Connecticut Agricultural Experiment Station, New Haven.
R. P. Kozloski, and B. L. Sawhney.
Bulletin of Environmental Contamination and Toxicity, Vol 29, No 1, p 1-6, 1982. 2 Fig, 1 Tab, 3 Ref.

Descriptors: *Groundwater pollution, *Gas chromatography, *Landfills, *Organic loading, Water pollution, Garbage dumps, Alcohols, Ethyl chloride, Acetone, Isopropanol, Diethyl ether, Methyl ethyl ketone, 2-Butanol, Benzene, Methyl isobutyl ketone, Toluene, Ethyl benzene, Solubility.

A procedure for analyzing volatile organic pollutants in groundwater by using the gas chromatography purge and trap method is described. Groundwater samples were collected from test wells. Retention times and successive purge ratios were determined using two different columns. The compounds were identified by comparing their retention times with those of standards. A sample collected near a landfill site indicated the presence of ten compounds: ethyl chloride, acetone, isopropanol, diethyl ether, methyl ethyl ketone, 2-butanol, benzene, methyl isobutyl ketone, toluene, and ethyl benzene. The technique showed constant peak ratios for various organic compounds, including a number of alcohols, ketones, and chlorinated hydrocarbon standards. The technique is useful for confirming the identity of GC peaks, the purity of peaks, and possible alterations in the solubility of trace organics. (Small-FRC)
W83-00158

ASSOCIATION STUDIES OF POLYBROMINATED BIPHENYLS IN AQUATIC SYSTEMS,
Michigan Univ., Ann Arbor. Dept. of Environmental and Industrial Health.
For primary bibliographic entry see Field 5B.
W83-00160

CHARACTERIZATION OF ORGANIC CONTAMINANTS IN ENVIRONMENTAL SAMPLES ASSOCIATED WITH MOUNT ST. HELENS 1980 VOLCANIC ERUPTION,
Geological Survey, Denver, CO.; and Bureau of Reclamation, Denver, CO. Denver Federal Center.
W. E. Pereira, C. E. Rostad, H. E. Taylor, and J. M. Klein.
Environmental Science and Technology, Vol 16, No 7, p 387-396, July, 1982. 8 Fig, 5 Tab, 32 Ref.

Descriptors: *Volcanoes, *Organic compounds, *Pollutant identification, Water pollution sources, Surface water, Organic matter, Pyrolysis, Hydrocarbons, Fatty acids, Organic acids, Aromatic compounds, Pulp and paper industry, Sediments, *Mt. St. Helens, Spirit Lake, Coldwater Creek, *Washington.

Volcanic ash, surface water, and river bottom sediments collected near Mt. St. Helens after the May 18, 1980, eruption were analyzed for organic compounds by capillary gas chromotography-mass spectrometry computer techniques. Alkanes, aromatic and polycyclic aromatic hydrocarbons, alcohols, fatty acids, dicarboxylic acids, ketones, aromatic acids, aldhydes, phenols, chlorinated aromatics, resin acids, terpenes, and insect juvenile hormones were identified. A total of 84 compounds were qualitatively identified in the ash, 42 in the bottom sediments, 73 in Spirit Lake water, and 71 in Coldwater Creek water. Nineteen compounds were common to both water samples. Many of these compounds, commonly found in pulp and paper mill effluents, adversely affect fish, insects, and other aquatic life, and cause oxygen depletion and tast and odor problems in streams. The most likely source of these compounds is the pyrolysis of plant and soil organic matter during and after the eruption. Although these hydrophilic compounds pose a potential groundwater contamination threat, no pollution has yet been detected in monitoring wells. (Cassar-FRC)
W83-00161

DETERMINATION OF BENZIDINES BY GAS CHROMATOGRAPHIC SEPARATION OF DERIVATIVES WITH ELECTRON CAPTURE DETECTION,
Cincinnati Univ., OH. Dept. of Mechanical Engineering.
F. K. Kawahara, J. R. Dunn, R. A. Fiutem, and P. J. McCullough.
Analytica Chimica Acta, Vol 138, p 207-220, 1982. 5 Fig, 3 Tab, 20 Ref.

Descriptors: *Wastewater analysis, *Water analysis, Organic compounds, *Pollutant identification, *Gas chromatography, Amines, Carcinogens, Aromatic compounds, *Benzidines.

A method for determining toxic, water soluble benzidines in wastewater used electron capture gas chromatography of the pentafluoropropionamide (PFP) derivatives. Wastewater and tap water spiked with benzidine were reacted with N-pentafluoropropiony-limidazole to obtain stable derivatives. A 10,000-fold excess of reagent was used. Several derivatization methods were tried and found less satisfactory than PFP imidazole. These were trifluoroacetic acid, N-methyl-bis-(trifluoroacetamide), and N-trifluoroacetylimidazole. The extraction of water samples was done at pH 8-10 using chloroform or methylene chloride. Overall recovery efficiencies were 91-103%. Four benzidine congeners were readily separated: the PFP derivatives of benzidine, dichlorobenzidine, 0-toli-

dine, and dianisidine. Detection limits were 50 fg. (Cassar-FRC)
W83-00182

AN OVERVIEW OF ACID RAIN MONITORING ACTIVITIES IN NORTH AMERICA,
Flow General, Inc., McLean, VA.
For primary bibliographic entry see Field 5C.
W83-00189

DETERMINATION OF IRON IN NATURAL WATERS AND PLANT MATERIAL WITH 1,10-PHENANTHROLINE BY FLOW INJECTION ANALYSIS,
Centro di Energia Nuclear na Agricultura, Sao Paulo (Brazil).
J. Mortatti, F. J. Krug, L. C. R. Pessenda, E. A. G. Zagatto, and S. S. Jorgensen.
Analyst, Vol 107, No 1275, p 659-663, June, 1982. 2 Fig, 1 Tab, 9 Ref.

Descriptors: *Iron, *Pollutant identification, *Water analysis, Metals, Heavy metals, *Flow injection analysis, *Spectrophotometry, Phenanthroline.

Total iron in natural waters was determined by the ascorbic acid with 1,10-phenanthroline method and flow injection analysis. The absorbance of the orange red complex, formed within a pH range of 2-9, was measured at 512 nm in a spectrophotometer equipped with a flow-through cuvette. A mixing coil length of 50 cm yielded good precision at a sampling rate of 150-180 determinations per hour for 500 microliter samples. At Fe concentrations of 1-5 ppm no interferences were produced from phosphate at 600 ppm, Cu at 20 ppm, Zn at 20 ppm, Al at 100 ppm and Co at 10 ppm. Ag at 10 ppm and Ni at 10 ppm interfered slightly. Samplesalyzed by the flow injection techniqu and by atomic absorption spectrometry produced excellent agreement within 1% relative standard deviation. For a 500 microliter sample volume and a 0.10-10.0 ppm Fe concentration, the detection limit was 0.02 ppm. (Cassar-FRC)
W83-00194

PRE-CONCENTRATION TECHNIQUE FOR COLD-VAPOUR ATOMIC-FLUORESCENCE DETERMINATION OF MERCURY IN DRINKING WATERS,
Severn-Trent Water Authority, Malvern (England). Malvern Regional Lab.
M. P. Bertenshaw, and K. Wagstaff.
Analyst, Vol 107, No 1275, p 664-672, June, 1982. 3 Fig, 5 Tab, 26 Ref.

Descriptors: *Mercury, *Sample preparation, *Water analysis, *Pollutant identification, Sample preservation, Metals, Heavy metals, Drinking water, Fluorescence, Trace levels, Atomic fluorescence spectroscopy, *Spectroscopy, Raw water.

A sample preconcentration step using a potassium permanganate solution trap permitted use of the cold vapor atomic fluorescence method for determination of inorganic and total mercury at levels from 1.6 to 700 ng per liter Hg in raw and potable waters. The preconcentration step, which required 250 ml of sample, took only 5 min per test. The trap solution was 1% m/V KMn04 in 5% V/V nitric acid with 0.1% m/V potassium dicromate, prepared fresh each day. Argon gas was bubbled through the water sample to purge the Hg into the trap solution. Standard deviation was < 2 ng per liter or 7% of the concentration. Organomercury complexes were made available for determination by digestion with potassium persulfate. Samples, containing ng levels of Hg, preserved with 0.01% m/V potassium dichromate and nitric acid (5% V/V), were stable for at least a week. (Cassar-FRC)
W83-00195

ACCURACY OF DETERMINATION OF AMMONIACAL NITROGEN IN RIVER WATERS: ANALYTICAL QUALITY CONTROL IN THE HARMONISED MONITORING SCHEME.
Water Research Centre, Marlow (England).
Analyst, Vol 107, No 1275, p 680-688, June, 1982. 5 Tab, 8 Ref.

Descriptors: *Quality control, *Ammonia, *Monitoring, Nitrogen compounds, Water analysis, Pollutant identification, Laboratories, Water quality, Rivers, Natural waters, *England, *Wales, *Scotland.

The procedures and results of an analytical quality control scheme in England, Scotland, and Wales are described. Eleven laboratories were involved in measuring ammonia concentrations < 0.1 mg per liter. One laboratory used a procedure involving distillation of ammonia and subsequent spectrophotometric determination with Nessler's reagent. All others used a semi-automated continuous flow spectrophotometric system based on formation of indophenol blue. Samples tested were 2 standard solutions, river water, and river water spiked with a known amount of ammonium chloride. The between-laboratory bias test were as follows: standard solution A, 1.70-1.98 mg per liter N obtained, 1.84 mg per liter expected; spiked river water B, 0.22-0.27 mg per liter obtained, 0.24 mg per liter expected; spiked river water C, 4.54-5.03 mg per liter obtained, 4.80 mg per liter expected. Thus biases were -11.3 to +9.2% for the individual laboratories. Targets were total errors of not greater than + or - 20% of the ammonia concentration or 0.1 mg per liter N, whichever was larger. (Cassar-FRC)
W83-00196

DETERMINATION OF ORGANIC CONTAMINANTS IN ULTRA-PURE WATER BY REVERSED-PHASE HIGH-PERFORMANCE LIQUID CHROMATOGRAPHY WITH ULTRAVIOLET DETECTION,
Berne Univ. (Switzerland). Inst. for Inorganic, Analytical and Physical Chemistry.
J. B. Reust, and V. R. Meyer.
Analyst, Vol 107, No 1275, p 673-679, June, 1982. 5 Fig, 12 Ref.

Descriptors: *Organic compounds, *Water purification, *Pollutant identification, Ultrafiltration, Distillation, Ultraviolet radiation, Liquid chromatography, Water analysis, Water pollution sources, *Chromatography.

Organic impurities were determined in water using high performance liquid chromatography on reversed phase columns with ultraviolet detection at 210 nm and at 254 nm. Water samples included Tap (from Berne, Switzerland), Ionex (deionized tap water), Bi (doubly distilled Ionex water), Tetra (Ionex water distilled 4 times), Ultra (subjected to several purification steps including reverse osmosis, activated carbon adsorption, ion exchange, and ultrafiltration), and Baker (commercial organic-free water). Quality of Tetra and Baker waters were similar using both wavelengths. Ionex, Bi, and Ultra showed considerable organic contamination using the 210 nm wavelength. Taking samples at different stages of the water purification processes allowed identification of the contaminant sources such as plastic tubing, glues, and housing material, in the purification systems. Sample handling techniques also contributed to organic contamination, including the use of open containers, lengthy sampling time (12 hours), and adsorption at the electrode surface in electrochemical procedures. (Cassar-FRC)
W83-00202

COMPARISON OF SULFIDE-SELECTIVE ELECTRODE AND GAS-STRIPPING MONITORS FOR HYDROGEN SULFIDE IN EFFLUENTS,
Atomic Energy of Canada Ltd. Chalk River (Ontario). Chalk River Nuclear Lab.
J. Gulens, H. D. Herrington, J. W. Thorpe, G. Mainprize, and M. G. Cooke.
Analytica Chimica Acta, Vol 138, p 55-63, 1982. 4 Fig, 1 Tab, 21 Ref.

Descriptors: *Hydrogen sulfide, *Wastewater analysis, *Monitoring, *Pollutant identification, Sulfides, Effluents, Industrial wastewater, Heavy water, Measuring instruments, Field tests.

Two hydrogen sulfide monitors were tested in continuous field operation at the Glace Bay Heavy Water Plant, Nova Scotia, over a 6-month period. They were the Orion Model 1516 monitor, based on the direct measurement of potential difference between a sulfide-selective electrode and a pH electrode, and the gas stripping monitor, which used a solid state sensor to detect H2S stripped from solution by an air-C02 mixture. The detection limit for both monitors was < 0.005 mg per kg. Both were simple to operate, calibrate, and maintain over the June to December outdoor field tests. Qualitative agreement between the 2 monitors was good. However, there were several occasions on which only one monitor responded to H2S excursions. Malfunctions were a result of oxidation of sulfide at the electrode surface by chlorine present in the effluent, presence of suspended solids and oils (up to 50% error), wetting of the solid state sensor, and a several days' period of no H2S exposure (decreased sensitivity of sensor). The gas stripping monitor, more tolerant of dirty samples than the Orion monitor, required daily adjustment of flow rates. The Orion monitor was less sensitive to sample flow rates and pH changes below pH 5. (Cassar-FRC)
W83-00204

IMPROVEMENTS IN QUANTIFYING THE PHOSPHORUS CONCENTRATION IN LAKE WATER,
Alberta Univ., Edmonton. Dept. of Zoology.
For primary bibliographic entry see Field 5C.
W83-00208

MINERALIZATION OF LINEAR ALCOHOL ETHOXYLATES AND LINEAR ALCOHOL ETHOXY SULFATES AT TRACE CONCENTRATIONS IN ESTUARINE WATER,
Procter and Gamble Co., Cincinnati, OH. Environmental Safety Dept.
For primary bibliographic entry see Field 5B.
W83-00211

COMPONENTS CONTRIBUTING TO LIGHT EXTINCTION IN NATURAL WATER: METHOD OF ISOLATION,
Southern Illinois Univ. at Carbondale. Dept of Botany.
J. Verdun.
Archiv fur Hydrobiologie, Vol 93, No 3, p 303-312, February, 1982. 2 Fig, 2 Tab, 15 Ref.

Descriptors: *Suspended solids, *Chlorophyll, *Light penetration, Lakes, Light extinction coefficient, Pigments, Organic matter, Photosynthesis, Respiration, Dissolved oxygen, Oxygen, Phytoplankton, *Lambert-Beer's Law, Carbon dioxide, Water analysis, *Pollutant identification.

The Lambert-Beer's Law relating light extinction to depth and concentration of light-quenching substances is reviewed. The light extinction coefficient (K) can be divided into 3 components: the suspensoid contribution (Ks), the dissolved pigment contribution (Kp), and the water contribution (Ka). The suspensoid fraction can be subdivided into: chlorophyll-correlated (SCh1), non-chlorophyll-related organic matter (So), and inorganic (Si). The components were estimated by determining the dry weight of suspensoids and the carbon: chlorophyll regressions which isolate the non-chlorophyll related carbon as the first term in the regression equation. Ks was equal to 0.12 sq m per g on the average. Ka and Kp were responsible for a small fraction of the total light extinction. The So fraction accounted for a considerable proportion of total suspensoids in lakes with low or high photosynthetic rates. Lakes with high relative So are likely to have an excess of respiration over photosynthesis, producing water supersaturated with C02 and undersaturated in dissolved oxygen. Lakes with a high relative Si are usually severely light limited. Those with dominant SCh1 are likely to have a high ratio of photosyntheses to respiration with high pH and oxygen supersaturation. (Cassar-FRC)
W83-00213

HAZARDOUS POLLUTANT ANALYSIS IN WATER USING INFRARED SPECTROSCOPY,

Connecticut Univ., Storrs. Inst. of Water Resources.
C. P. Anderson, and A. P. Bentz.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-108373, Price codes: A02 in paper copy, A01 in microfiche. Completion Report, March 1982. 21 p, 11 Fig, 5 Tab. OWRT A-080-CONN(2), 14-34-0001-0107.

Descriptors: Pollutants, *Hazardous materials, *Water analysis, *Organic compounds, *Infrared spectroscopy, *Chemical analysis, Water pollution, Water pollution control, Volatility, Spectral analysis, Spectrometers, Spectrophotometry, Isolation, Thin-layer chromatography, Computers, Libraries, Information retrieval, *Pollutant identification.

A simple procedure involving an extraction-concentration method followed by computer infrared (IR) spectral enhancement was developed which provides detection and identification of organic pollutant compounds of moderate-to-low volatility in estuarine and coastal waters, down to 1-10 ppm (depending on the IR absorptivity of the compounds). The procedure produces IR spectra of adequate quality for pollutant identification by a computer spectral library search. This method of identification is appropriate provided that other organic pollutants are not present in equivalent concentrations and that background levels of dissolved organics (e.g., petroleum products, fish oil) do not exceed levels commonly found in the Thames River or Fishers Island Sound. In instances where samples involve multiple pollutants or high natural background levels, a thin-layer chromatography (TLC) technique was found to provide adequate separation and cleanup. The TLC separation-cleanup approach also afforded the ability for extension of detection limits for the pollutants downwards to about 100 ppb to 1 ppm, requiring a slight cost for additional sample preparation. It was concluded that IR spectroscopy can be used to identify waterborne organic compounds at about 500 ppb, and detect them in the range of 100 ppb. Water salinity in such samples is not a factor in the extraction of the compounds. Since IR can be used for nonvolatile compounds, it is a natural complement to gas chromatographic techniques. (Zielinski-MAXIMA)
W83-00231

THE CHEMICAL COMPOSITION OF WATER AND THE ANALYTICAL CHEMIST: A CHALLENGE,
Hydrological Research Inst., Pretoria (South Africa).
W. H. J. Hattingh.
Technical Report No 85, 1979. 10 p, 7 Fig, 8 Tab, 31 Ref.

Descriptors: *Water analysis, *Chemical analysis, *Chromatography, *Spectroscopy, *Pollutant identification, Chemical wastes, Water quality, Water sampling, Sample preparation, Sample preservation, Sampling, Heavy metals, Trace elements, Spectral analysis, Detergents, Pesticides, Public health, Inorganic compounds, Organic compounds, Chemical composition, Water pollution.

Advances in analytical tools available to the chemist over the past 25 years for analysis of the chemical composition of water samples are reviewed. Particular emphasis is placed on current analytical capabilities and in the increased complexity in water contaminants. Contaminants covered include synthetic detergents, pesticides, chemicals used in water purification, and various inorganic and organic contaminants. Modern analytical techniques for inorganic water constituents are atomic absorption (including inductively-coupled plasma), automated colorimetric analysis, and selective membrane electrodes; for organic water constituents, capillary gas chromatography (GC) with element-specific detectors, GC-Fourier transform/infrared spectroscopy, GC-mass spectrometry, and high-pressure liquid chromatography; and, for broad analytical use, the minicomputer for real-time data collection and reduction. Most analytical techniques for inorganic constituents may be automated and minicomputer-linked; as a result, analyses have increased 11-fold (2435 to over 27,000 per chemist) over the past six year. For organic constituents, the development of more sensitive techniques has also resulted in a rapid increase in compounds detected. Water quality standards relative to inorganic and organic contaminants are also reviewed. (Zielinski-MAXIMA)
W83-00290

DETERMINATION OF BENZIDINES IN INDUSTRIAL AND MUNICIPAL WASTEWATERS,
Battelle Columbus Labs., OH.
R. M. Riggin, and C. C. Howard.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-196320, Price codes: A05 in paper copy, A01 in microfiche. Environmental Protection Agency, Project Summary EPA-600/S4-82-022, May 1982. 5 p, 1 Tab. 68-03-2624.

Descriptors: *Pollutant identification, *Wastewater analysis, *Benzidines, *Water analysis, *Chromatography, *Dye industry wastes, Chemical analysis, Effluents, Sample preservation, Industrial wastewater, Municipal wastewater.

A method for the determination of benzidine and 3,3'-dichlorobenzidine (DCB) in wastewater was developed. This method, based on the use of high performance liquid chromatography with electrochemical detection, is selective for readily oxidized, basic compounds, and can detect as little as 0.1 ppb of benzidine and DCB in many types of aqueous samples, including surface water, municipal sewage, and industrial effluent samples. However, several dye plant effluents contained many oxidizable materials which decreased the sensitivity of the method to about 1 ppb for benzidine and DCB. Apparent levels of 10-20 ppb of benzidine were present in the dye plant effluents. For one dye plant, effluent benzidine was determined to be 9 ppb and 12 ppb using two different sets of chromatographic conditions thus supporting the belief that benzidine is present at the level stated. Precision and accuracy of the method were estimated from the results for five wastewater samples spiked at levels between 1 and 50 ppb. For this group of samples the recoveries were 69 + or - 15% for benzidine and 76 + or - 9% for DCB. Storage of several wastewater samples for (two or seven days) at 41C and pH 2 resulted in degradation of the compounds in several cases, probably due to oxidation or irreversible adsorption to particulate matter. Therefore, in order to obtain accurate values for benzidine and DCB, it is believed to be necessary to assay the sample as soon after collection as possible. For samples containing chlorine, a reducing agent such as sodium thiosulfate must be added, since chlorine was found to rapidly degrade benzidine and DCB. (Author's abstract)
W83-00292

INCREASING ARCAT TEST SENSITIVITY FOR EXAMINATION OF POTABLE WATERS,
Atlantic Research Corp., Alexandria, VA.
For primary bibliographic entry see Field 5F.
W83-00293

PRECONCENTRATION OF ENVIRONMENTAL TIN AND ITS DETERMINATION USING CATECHOL VIOLET,
Reading Univ. (England). Dept. of Chemistry.
M. Omar, and H. J. M. Bowen.
Analyst, Vol 107, No 1275, p 654-658, June, 1982. 1 Fig, 2 Tab, 30 Ref.

Descriptors: *Tin, *Pollutant identification, Metals, Heavy metals, *Water analysis, Sediments, Lake sediments, *Spectrophotometry.

Inorganic tin was determined in natural waters by preconcentration in polyurethane foam soaked in toluene-3,4-dithiol followed by spectrophotometric measurement of its catechol violet and cetyltrimethylammonium bromide (CTAB) complex. The preconcentration step was accomplished by reducing any Sn(4+) to Sn(++) with mercaptoacetic acid at pH 4, and passing the 1 liter sample through a 15 cm long, 1.5 cm diameter glass column containing 0.4 g of polyurethane foam-dithiol at the rate of 3-5 ml per min. The column was eluted with acetone and 1 M NaOH at 2 ml per min. The first 2.5 ml of eluate was discarded. Concentration was 100-fold. After wet ashing, dissolving with 5M sulfuric acid, addition of 5M potassium iodide solution, and extraction with toluene, the aqueous phase was treated with catechol violet and CTAB to form a complex. Absorbance was measured at 650 nm. Interfering elements were Ge, Mo, and Sb(5+). Tin was determined in reference materials, 8 geological and 4 biological. Recoveries were 96 + or - 3%, as determined by tracer studies, and concentrations were on the same order as those obtained by other researchers. Lake sediment and water samples analyzed by the method had tin levels of 5.3 + or - 0.3 micrograms per g and 1.07 + or - 0.21 ng per g, respectively. Although this method allowed separation of Sn(++) from Sn(4+) in distilled water, it was not successful with natural waters. (Cassar-FRC)
W83-00348

5B. Sources Of Pollution

MUNICIPAL POINT SOURCE AND AGRICULTURAL NONPOINT SOURCE CONTRIBUTION TO COASTAL EUTROPHICATION,
Tennessee Valley Authority, Knoxville, TN.
A. M. Duda.
Water Resources Bulletin, Vol 18, No 3, p 397-407, June, 1982. 6 Fig, 2 Tab, 42 Ref.

Descriptors: *Coastal pollution, *Water pollution effects, *Eutrophication, *Farm wastes, *Estuaries, *Water pollution sources, Nutrients, Animal wastes, Fishkill, Tidal rivers, Tidal effects, Nuisance algae, Municipal wastes, Coastal waters, Nitrogen, Phosphorus, Nitrates, *North Carolina, Chowan River.

Some tidal coastal rivers of eastern North Carolina are suffering from serious water quality deterioration in the form of massive algal blooms, fish kills, red sore disease among fish, fresh water intrusion into estuaries and decline of commercial and sport fishing. A study of point and nonpoint sources of nutrient inputs was carried out on the eutrophic Chowan River. Nonpoint source loading was the major cause of nutrient flux from the river basin, accounting for 97% of the nitrogen and 94% of the phosphorus load entering the Chowan River watershed. Levels of nitrate nitrogen and total phosphorus were from 5 to 40 times greater in agricultural watersheds than in forested watersheds of the river basin. The timing of the spring input of nutrients from nonpoint sources and the high levels of nutrients recorded in agricultural watersheds implicate agricultural sources as an important factor in determining whether massive blooms of blue-green algae occur during a given year in the Chowan River. In years with high spring precipitation, massive surface blooms of algae have occurred. In years with low spring flows, the noxious blooms do not occur despite continued input of municipal and industrial point source discharges. The present data suggests that the coastal eutrophication in question is arising mainly from farming and animal operations along the Chowan River basin. Agricultural drainage improvements such as tile drains, intensive ditch systems, and channelization projects through wetlands may ease the situation. (Geiger-FRC)
W83-00001

AEROBIC DEGRADATION OF DIURON BY AQUATIC MICROORGANISMS,
Clemson Univ., SC. Dept. of Microbiology.
P. A. Ellis, and N. D. Camper.
Journal of Environmental Science and Health, Part B, Vol 17, No 3, p 277-289, 1982. 4 Tab, 13 Ref.

Descriptors: *Diuron, *Biodegradation, *Fate of pollutants, *Microorganisms, Herbicides, Pesticides, Pesticide kinetics, Urea pesticides, Degradation, Degradation products, Bacteria, *Aerobic conditions, Fungi, Sediments, Adsorption, Ponds, Agricultural chemicals.

The aerobic degradation of diuron by microorganisms isolated from pond water and sediments was examined in laboratory tests. Cultures capable of

degrading the herbicide were isolated by enrichment techniques. Cultures capable of degrading diuron included several mixed fungal/bacterial cultures and some mixed bacteria cultures. These mixed cultures degraded from 67 to 99% of the added herbicide, forming from six to seven degradation products which were separated by thin-layer chromatography methods. A major degradation product found in most cultures was 3,4-dichloroaniline. Other commonly found products were 3-(3,4-dichlorophenyl)-2-methylurea and 3-(3,4-dichlorophenyl)urea. N-Demethylation of the herbicide appeared to be by far the major pathway of degradation by the cultures obtained in both enrichment series (water and sediment collected in April and August) and in the mixed cultures. (Geiger-FRC)
W83-00002

THE INCIDENCE OF VIBRIO CHOLERAE IN WATER, ANIMALS AND BIRDS IN KENT, ENGLAND,
Preston Hall Hospital, Maidstone (England). Public Health Lab.
J. V. Lee, D. J. Bashford, T. J. Donovan, A. L. Furniss, and P. A. West.
Journal of Applied Bacteriology, Vol 52, No 2, p 281-291, 1982. 1 Fig, 5 Tab, 31 Ref.

Descriptors: *Vibrio, *Fate of pollutants, *Gulls, *Brackish water, Bacteria, Cholera, Path of pollutants, Salinity, Waterfowl, Birds, Water birds, Human diseases, Sodium, Sheep, Natural waters, Public health, *England.

A three year study was carried out in Kent, England to establish whether Vibrio cholerae occurred in the natural waters there and to see if its incidence could be related to any other factors such as the input of sewage effluent into the environment. Several surveys showed that the bacterium occurred sporadically in all types of water during the summer but only in small numbers in waters of low salinity (< 5 millimoles sodium ion/liter). The greatest numbers of colony forming units were detected in static brackish waters containing 25-200 millimoles of sodium ion/liter. No correlation was found between E. coli and V. cholerae counts. It was concluded that V. cholerae was not introduced by sewage contamination of water supplies. A large number of serovars, including 01, the causative agent of pandemic cholera, were identified. V. cholerae was detected in 6% of the cloacal swabs taken from gulls caught at times when the bacterium could not be isolated from water. It was concluded that the presence of these organisms in the environment in Kent does not present any significant threat to health. Aquatic birds were seen as possible vectors of V. cholerae. It was also concluded that V. cholerae occurred naturally in static brackish water. (Geiger-FRC)
W83-00012

CHARACTERIZATION OF PLUTONIUM IN GROUND WATER NEAR THE IDAHO CHEMICAL PROCESSING PLANT,
Geological Survey, Lakewood, CO.
J. M. Cleveland, and T. F. Rees.
Environmental Science and Technology, Vol 16, No 7, p 437-439, July, 1982. 1 Fig, 3 Tab, 6 Ref.

Descriptors: *Plutonium, *Radioactive waste disposal, *Groundwater pollution, Path of pollutants, Fate of pollutants, Waste disposal, Leachates, Disposal wells, Chelation, Adsorption, Idaho, Chemical reactions.

Plutonium-238 in very low concentrations, 55-78 fCi per liter, was detected in one monitoring well about 200 meters from the disposal well at the Idaho Chemical Processing Plant, which processes highly enriched uranium fuels. The waste solution discharged into the disposal well contained an average Pu238 concentration of 1037 fCi per liter. At wells located further from the disposal site Pu238 concentrations were less than the detection limit of 10 fCi per liter. Therefore, about 80% of the Pu238 had been removed by precipitation or sorption during its travel through the soil. Pu238 was present in the uncomplexed, perhaps hydroxy, tetravalent state because strong organic complexing agents were not present in this location. Pu238 was present in such low concentrations in the wells primarily due to the absence of these same organic complexing agents which would have stabilized Pu238 against precipitation or sorption. This study serves to emphasize the need for isolating plutonium-containing wastes from dissolved organic species in ground water. (Cassar-FRC)
W83-00019

INDUCTION OF HIGH PHOSPHATASE ACTIVITY BY ALUMINUM IN ACID LAKES,
Uppsala Univ. (Sweden). Inst. of Limnology.
M. Jansson.
Archiv fur Hydrobiologie, Vol 93, No 1, p 32-44, November, 1981. 3 Fig, 4 Tab, 11 Ref.

Descriptors: *Enzymes, *Aluminum, *Acidic water, Lakes, Lake Gardsjon, *Sweden, *Phosphatases, Iron, Metals, Phytoplankton, Algae, Inhibition, Hydrolysis, Water pollution effects, Fate of pollutants.

Acid phosphomonoesterase activity in acid (pH 4.5) Lake Gardsjon, Sweden, is 10 times higher than in other Swedish lakes. This study investigated the mechanisms behind the phenomenon and concluded that Al(3+) at the high concentrations present in the lake (0.3 mg per liter) reacted with available phosphates, thus blocking the natural substrates and preventing enzymatic recycling of organic P. Organisms in the lake increased production of phosphatases to compete with the Al. Experiments revealed that: (1) the Al(3+) and Fe(3+) combined with the phosphate group on the substrate, making it unavailable to enzymatic attack; solutions of the metals at concentrations as low as 0.00005 M were inhibitory; (2) both enzymes and metals competed for the esterified phosphate, (3) the high phosphatase concentration in the lake was sufficient to outcompete the high levels of Al in the water; Fe concentration was too low to have a significant effect; and (4) artificially increasing the metal-to-phosphatase ratio produced increases in phosphatase production. (Cassar-FRC)
W83-00029

WATER QUALITY OF STREAMS IN THE GREAT SMOKY MOUNTAINS NATIONAL PARK,
Great Smoky Mountains National Park, Gatlinburg, TN. Uplands Field Research Lab.
D. G. Silsbee, and G. L. Larson.
Hydrobiologia, Vol 89, No 2, p 97-115, April, 1982. 10 Fig, 6 Tab, 34 Ref.

Descriptors: *Natural streams, *Water quality management, *Monitoring, *Watershed management, *Water pollution sources, Physical properties, *Chemical properties, Biological properties, Streams, Water quality control, Forest watersheds, Hydrogen ion concentration, Turbidity, Minerals, Nitrates, Seasonal variation, Alkalinity, Elevation, *Smoky Mountains, Mountains, Sodium, Potassium, Calcium, Magnesium, Silicon, Bacteria, Logging, Storms.

A one-year water monitoring program was conducted on streams of the Great Smoky Mountains National Park to establish which factors were most important in controlling streamwater quality and to provide baseline information for long term monitoring of park water quality and future aquatic research. Sixteen physical, chemical, and bacteriological water quality parameters were evaluated at the base of most of the 28 major drainages in the park. In the lower elevations, values for bacterial density, pH, alkalinity, turbidity, and concentrations of Na, K, an Si were higher than those recorded at higher elevations. Nitrate levels increased with elevation. In watersheds where logging was practiced, nitrate concentrations were significantly lower than those of unlogged watersheds at similar elevations. Alkalinity, pH, conductivity, hardness, and levels of Na, K, Ca, Mg and Si were affected by bedrock geology. Most water quality parameters exhibited higher concentrations or values in the summer than in the winter. Discharge and nitrate concentrations were both highest in winter and spring and lowest in fall. Storm events frequently caused dramatic changes in streamwater quality. (Geiger-FRC)
W83-00032

PHYSICOCHEMICAL LIMNOLOGY OF THE TONGUE RIVER RESERVOIR, MONTANA,
Alaska Univ., Fairbanks. Inst. of Marine Science.
For primary bibliographic entry see Field 2H.
W83-00033

LIMNOLOGICAL INVESTIGATIONS OF A MOUNTAIN SPRING POND IN THE SWISS NATIONAL PARK,
Zurich Univ. (Switzerland). Hydrobiological-Limnological Station.
For primary bibliographic entry see Field 2H.
W83-00034

SOME NOTES ON THE ECOLOGY OF AQUATIC OLIGOCHAETES IN THE DELTA REGION OF THE NETHERLANDS,
Provincial Water Authority, Zwolle (Netherlands). Dept. of Watershed Management.
For primary bibliographic entry see Field 2L.
W83-00035

INVESTIGATIONS ON THE LAKES OF PERU AND THEIR PHYTOPLANKTON. 6 ADDITIONAL CHEMICAL ANALYSES,
Kernforschungsanlage, Juelich (Germany, F.R.). Inst. fuer Biotechnologie III.
For primary bibliographic entry see Field 2H.
W83-00037

ADSORPTION OF PAH TO AQUATIC HUMUS,
Norwegian Inst. for Water Research, Oslo (Norway).
E. T. Gjessing, and L. Berglind.
Archiv fur Hydrobiologie, Vol 92, No 1, p 24-30, August, 1981. 1 Fig, 2 Tab, 14 Ref.

Descriptors: *Aromatic compounds, *Humic acids, *Adsorption, *Polyaromatic hydrocarbons, Benzo(a)pyrene, Hydrocarbons, Organic matter, Color, Fate of pollutants, Pollutant identification, Water analysis, Organic compounds.

Polyaromatic hydrocarbons (PAH) added to natural waters containing humus were only 2-7% extractable by cyclohexane and 46-76% extractable by the XAD-2 ion exchange recovery technique, both common methods of determining PAH. The water samples varied in color from 22 to 105 mg Pt per liter and in dissolved organic concentrations from 5 to 14 mg C per liter. None were impacted by human activity. These results suggest that PAH levels in humic waters are underestimated and that mobility of PAH is increased in the presence of humus. (Cassar-FRC)
W83-00038

METAL BINDING CAPACITY IN RELATION TO HYDROLOGY AND ALGAL PERIODICITY IN TJEUKEMEER, THE NETHERLANDS,
Limnological Inst., Oosterzee (Netherlands). Tjeukemeer Lab.
H. De Haan, T. De Boer, and H. L. Hoogveld.
Archiv fur Hydrobiologie, Vol 92, No 1, p 22-23, August, 1981. 5 Fig, 1 Tab, 34 Ref.

Descriptors: *Copper, *Chelation, *Algae, Lakes, Humic acids, Fulvic acids, Color, Organic matter, Tjeukemeer Lake, *The Netherlands, Polders, Chlorophyll A, Phytoplankton, Productivity, Eutrophication, Fate of pollutants, Decomposing organic matter, Iron nutrients, Algal growth.

The copper binding capacity (CuBC) of Tjeukemeer water was monitored from June 1977 to December 1979. This shallow productive peaty lake in the Netherlands receives humus-rich water in winter and humus-poor water in summer. CuBC ranged from 250 micrograms per liter in fall to 800 micrograms per liter in summer, average 490 micrograms per liter, as measured by the dibenzyldithiocarbamate method. Correlation of

water color and CuBC in 1979 suggested that the CuBC was controlled by the input of polder water high in fulvic acids. The polder water was richer in organic carbon than the lake, but the ratio of CuBC per unit of organic carbon was higher in lake water, a result of the higher chlorophyll a levels in the lake. Summer peak values of CuBC in 1977 and 1978 were associated with the decline of the blue-green algal populations of Aphanizomenon spp. and Oscillatoria redekei. Another peak observed in November 1977 was attributed to the decline of a green algal population, Planctonema lauterbornii. A high CuBC in October 1978 was seen during an algal bloom (Aphanizomenon spp.) during low Fe concentrations. This suggested that the Aphanizomenon cells excreted metal chelators under Fe limitation conditions. (Cassar-FRC)
W83-00039

NITROGEN METABOLISM IN LAKE KIZAKI, JAPAN. III. ACTIVE NITRIFICATION IN EARLY SUMMER,
Nagoya Univ. (Japan). Water Research Inst.
For primary bibliographic entry see Field 2H.
W83-00040

PHYTOPLANKTON CONTRIBUTION TO ALKALINE PHOSPHATASE ACTIVITY,
Oak Ridge National Lab., TN. Environmental Sciences Div.
For primary bibliographic entry see Field 2H.
W83-00041

DIFFERENTIAL PULSE POLAROGRAPHY OF SOME HERBICIDES DERIVED FROM 2,4-DICHLOROPHENOXYACETIC ACID, II. DETERMINATION OF HERBICIDE RESIDUES IN IRRIGATION WATERS,
Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Chemie.
For primary bibliographic entry see Field 5A.
W83-00045

DIEL PERIODICITY IN THE CHEMICAL COMPOSITION OF LAKE PHYTOPLANKTON,
University of Science and Technology, Kumasi (Ghana). Dept. of Biological Sciences.
E. Frempong.
Archiv fur Hydrobiologie, Vol 92, No 4, p 457-495, November, 1981. 7 Fig, 8 Tab, 50 Ref.

Descriptors: *Diurnal distribution, *Phytoplankton, *Biomass, Seasonal variation, Statistical analysis, Carbohydrates, Chemical composition, Esthwaite Water, *England, Stratification, Chlorophyll a, Carotenoids, Nitrogen, Carbon, Lakes, Particulate matter, Irradiation, Chemical composition, Algae, *Eutrophic lakes.

Several indices of biomass and physiological state were determined for phytoplankton in the productive Esthwaite Water, England, for eight 24 hour periods between June 1977 and September 1978. Various ratios were used as indicators of diel periodicity. Ratios of carbohydrate to chlorophyll a, carbon, or nitrogen were more sensitive, by at least a factor of 2, to diel variations in the 0-8 m water column than other ratios, chlorophyll a:carbon, carbon:nitrogen, and carotenoids:chlorophyll a. In April the carbohydrate indices showed diel changes of + or - 21%, whereas other indices of biomass composition showed 4-7% variation. Factors which strongly affected the indices were seasonal variation, phase of stratification, dominant algal species, redistribution of biomass, and high surface irradiance. Indices involving carbohydrate are seen as useful indicators in monitoring diel periodicities in the physiological state and biomass of phytoplankton. (Cassar-FRC)
W83-00049

STORAGE OF CARBON AND TRANSPORT OF OXYGEN IN RIVER MACROPHYTES: MASS-BALANCE, AND THE MEASUREMENT OF PRIMARY PRODUCTIVITY IN RIVERS,
Miljostyrelsen, Silkeborg (Denmark). Freshwater Lab.
B. Moeslund, M. G. Kelly, and N. Thyssen.
Archiv fur Hydrobiologie, Vol 93, No 1, p 45-51, November, 1981. 2 Fig, 1 Tab, 4 Ref.

Descriptors: *Aquatic plants, *Vascular tissues, *Oxygen transfer, *Productivity, Lag time, Bicarbonates, Carbon dioxide, Rivers, Mosses, Algae, Macrophytes, *Primary productivity, Mass transfer, Plant tissues, Aeration, Light intensity.

For several species of vascular river macrophytes the lag time between onset of illumination and the start of inorganic carbon uptake and the lag between darkness and cessation of carbon uptake were 3-5 min. The species were Ceratophyllum demersum, Elodea canadensis, Myriophyllum alterniforum, Potamogeton crispus, and Sparganium sp. Cladophora glomerata, an alga, and Fontinalis antipyretica, a moss, showed similar lag times. Therefore, storage of inorganic carbon in aerenchyma was negligible and unimportant for measuring or modeling productivity. The photosynthetic quotients of laboratory plants without roots and in river plant communities were similar, suggesting that transport of gases to and from the roots is unimportant for plants rooted in well-aerated sediments. (Cassar-FRC)
W83-00051

SOME ASPECTS OF THE COLONIZATION BY WATER MITES (ACARI, ACTINEDIDA) OF AN ARTIFICAL SUBSTRATE IN A DISTURBED ENVIRONMENT,
Louvain Univ. (Belgium). Lab. of General and Experimental Ecology.
For primary bibliographic entry see Field 5C.
W83-00054

SPECIES COMPOSITION AND DISTRIBUTION OF ZOOPLANKTON IN A TROPICAL LAKE, LAKE NAIVASHA, KENYA,
Nairobi Univ. (Kenya). Dept. of Zoology.
K. M. Mavuti, and M. R. Litterick.
Archiv fur Hydrobiologie, Vol 93, No 1, p 52-58, November, 1981. 2 Fig, 2 Tab, 7 Ref.

Descriptors: *Zooplankton, *Seasonal variation, *Species composition, Lakes, Lake Naivasha, *Kenya, Species diversity, Invertebrates, Copepods, Cladocerans, Rotifers, Tropical regions, Fish food organisms, Predation, Biomass, Benthos, Food chains.

The zooplankton community of Lake Naivasha, Kenya, was documented for the first time from July 1978 to July 1980. Samples were collected weekly at a depth of 7 meters at 3 stations in the main lake area. The dominant limnetic zooplankton were the copepod Thermocyclops oblongatus, the cladocerans Diaphanosoma excisum and Simocephalus vetulus, and the rotifers, Brachionus caudatus and B. calyciflorus. A total of 26 species were recorded, including Daphnia laevis, for the first time in Kenya. D. laevis and Simocephalus vetulus, which produced occasional population eruptions, were responsible for about 10% of the cladoceran biomass. Total zooplankton increased from 60 individuals per liter in December to a stable population of 200-300 per liter in spring. After July the population declined until the November-December low. T. oblongatus represented 58% (102 + or - 53 individuals per liter) of the total numerical count of zooplankton. Rotifers contributed < 5% to the total zooplankton biomass. Biomass showed a complex pattern with 2 annual peaks, coinciding with the 2 rainy seasons in fall and spring. Annual mean standing crop was 220 mg dw per cu m, range 70-370 mg dw per cu m. Lack of predation causes S. vetulus, usually a littoral cladoceran, to be found in both littoral and limnetic locations. Nearly all zooplankton production enters the decomposer food chain. (Cassar-FRC)
W83-00056

AN APPRAISAL OF SURFACE-WATER QUALITY IN THE ALAMEDA CREEK BASIN, CALIFORNIA, OCTOBER 1974-JUNE 1979,
Geological Survey, Menlo Park, CA. Water Resources Div.
L. E. Lopp.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-201575, Price codes: A03 in paper copy, A01 in microfiche. Water-Resources Investigations 81-46, December, 1981. 33 p, 12 Fig, 4 Tab, 11 Ref.

Descriptors: *Surface water, *Water quality, *Wastewater, *Surface-groundwater relations, Recharge, Wastewater disposal, Water analysis, Water properties, *California, Alameda Creek basin.

Areal and seasonal variations in the quality of surface water in the Alameda Creek basin, California., from 1974 to 1979 were analyzed to determine the effects of wastewater discharges and imported water releases. Statistically significant differences were found among mean values of constituents in streamflow below the treated wastewater discharge points, imported water released from the South Bay Aqueduct, and the combined outflow at Alameda Creek near Niles. During periods before and after the drought of 1976-1977, concentrations of dissolved solids, dissolved chloride, and total nitrate varied inversely with water discharge. From 1974 to 1976, decreases in nutrient values coincided with increased in imported water releases. Values of physical properties and chemical constituents decreased during the spring and summer of 1976. During the second winter of the drought, imported water was decreased, and concentrations of dissolved solids, chloride, and total nitrate increased dramatically in the water at Alameda Creek near Niles. At the upstream tributary, Arroyo de la Laguna, increased chemical property and constituent values during 1976 and 1977 were attributed to decreased natural flow, hence the greater contribution of wastewater treatment plant effluent. Concentrations of several constituents exceeded limits set by the State water-quality objectives for the basin. With the return to normal flow levels in 1978-79, some concentrations returned to predrought levels. (USGS)
W83-00064

INSTALLATION AND SAMPLING OF OBSERVATION WELLS AND ANALYSES OF WATER FROM THE SHALLOW AQUIFER AT SELECTED WASTE-DISPOSAL SITES IN THE MEMPHIS AREA, TENNESSEE,
Geological Survey, Memphis, TN. Water Resources Div.
W. S. Parks, D. D. Graham, and J. F. Lowery.
Available from the OFSS, USGS Box 25425, Fed. Ctr. Denver, CO 80225, Price: $4.50 in paper copy, $3.50 in microfiche. Open-File Report 82-266, 1982. 32 p, 7 Fig, 3 Tab, 6 Ref.

Descriptors: *Water quality, *Groundwater, *Waste disposal, *Observation wells, Water sampling, Water analysis, Aquifers, Alluvial deposits, Confining beds, Water level, Recharge, Leakage, Landfills, Contamination, Water pollution, Data collections, *Tennessee, Memphis, Memphis sand.

Observation wells were installed and sampled at six abandoned waste-disposal sites in the Memphis area that have been identified as having received unknown quantities and types of industrial waste. Ten wells were installed adjacent to and downgradient from these sites in the shallow water-table aquifer. Water samples were collected from these 10 wells and from two other wells in the shallow water-table aquifer. Most wells were sampled twice -- initially in the early summer when water levels were high and again in the fall when water levels were low. Other wells were sampled only once in either the summer or fall. The water was analyzed for common constituents, selected trace constituents, and selected organic compounds. (USGS)
W83-00066

EFFECTS OF EFFLUENT SPRAY IRRIGATION ON GROUND WATER AT A TEST SITE NEAR TARPON SPRINGS, FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
D. P. Brown.
Open-File Report 81-1197, 1982. 36 p, 9 Fig, 13 Tab, 16 Ref.

Descriptors: *Groundwater, *Water quality, *Path of pollutants, *Effluents, Spray irrigation, Obser-

vation wells, Monitoring, Agricultural chemicals, Fertilizers, Nitrogen compounds, Bacteria, Aquifers, Chemical analysis, *Florida, Tarpon Springs.

Secondary-treated effluent was applied to a 7.2-acre test site near Tarpon Springs, Fla., for about 1 year at an average rate of 0.06 million gallons per day and 3 years at 0.11 million gallons per day. Chemical fertilizer was applied periodically to the test site and adjacent areas. Periodic mounding of the water table occurred due to effluent irrigation, inducing radial flow from the test site. Physical, geochemical, biochemical processes effectively reduced total nitrogen concentration 90% and total phosphorous concentration more than 95% in the ground water of the surficial aquifer about 300 feet downgradient from the test site from that of the applied effluent. Downgradient, total nitrogen averaged 2.4 milligrams per liter and total phosphorus averaged 0.17 milligrams per liter. Substantial increases in total phosphorus were observed when the pH of the ground water increased. Total coliform bacteria in the ground water of the surficial aquifer were generally less than 100 colonies per 100 milliliters. Fecal coliform bacteria were generally less than 25 colonies per 100 milliliters at the test site and were not detected downgradient or near the test site. Fecal streptococcal bacteria were generally less than 100 colonies per 100 milliliters at the test site, but were detected on three occasions near the test site. (USGS)
W83-00068

GEOHYDROLOGIC DESCRIPTIONS OF SELECTED SOLID-WASTE DISPOSAL SITES,
Geological Survey, San Juan, PR. Water Resources Div.
A. Torres-Gonzalez, and F. Gomez-Gomez.
Available from the OFSS, USGS Box 25425, Fed. Ctr. Denver, CO 80225, Price: $19.75 in paper copy, $3.50 in microfiche. Open-File Report 81-490, 1982. 146 p, 51 Fig, 28 Tab, 28 Ref, Append.

Descriptors: *Water quality, *Streams, *Water pollution, *Solid waste disposal, Sites, Leachates, Permeability, Path of pollutants, Headwaters, Water table, *Puerto Rico.

Fifty solid-waste disposal sites in Puerto Rico were examined in 1977 and ranked according to their potential for degradation of the water resources. Twenty-five of the sites show significant leachate pollution potential. The cover material at 21 sites is relatively permeable and offers insignificant attenuation to leachates. Thirty-six sites are adjacent to streams and nine of these are located in headwater areas. Rainfall is abundant and at 40 of the sites exceeds 1,500 millimeters per years. General descriptions of the 50 disposal sites are given with their geohydrologic setting. Baseline data consisting of specific conductance, pH, temperature, dissolved oxygen, and common ions were obtained at many of the sites. Such information provides a technical basis for assessing future effects of those solid-waste disposal sites on the quality of water resources. (USGS)
W83-00072

WATER-QUALITY ASSESSMENT OF STEINER BRANCH BASIN, LAFAYETTE COUNTY, WISCONSIN,
Geological Survey, Madison, WI. Water Resources Div.
For primary bibliographic entry see Field 4A.
W83-00123

A STUDY OF TRENDS IN TOTAL PHOSPHORUS MEASUREMENTS AT NASQAN STATIONS,
Geological Survey, Reston, VA. Water Resources Div.
R. A. Smith, R. M. Hirsch, and J. R. Slack.
Available from Supt. of Documents, GPO, Washington, DC 20402, Price, $4.50. Water-Supply Paper 2190, 1982. 34 p, 11 Fig, 4 Tab, 17 Ref, 2 Append.

Descriptors: *Water quality, *Phosphorus, *Water pollution control, *Statistical methods, Eutrophication, Nutrients, Nonpoint source pollution, Data collections, *Nasqan, Seasonal Kendall test.

A new test for trend, called the Seasonal Kendall test, is defined. The test is shown to have properties that make it a good test for detecting trends in water-quality data. As a demonstration, the test is applied to 5- to 8-year time series of total phosphorus data collected monthly at more than 300 stations in the National Stream Quality Accounting Network (NASQAN). The test is applied to time series of concentration values, instantaneous transport (load) values, and flow adjusted concentrations. Flow adjusted concentrations are defined as the residuals from a regression of concentration on a function of stream discharge. For each station, the regression function is selected from among 11 possible relationships on the basis of R2 value. Under 2 different significance criteria (alpha = 0.10 and alpha = 0.01, two-tailed), significant trends are observed at far more NASQAN stations than would be expected by change alone. Of 303 stations tested for trends in phosphorus concentration, 38 showed significant (alpha = 0.10) uptrends and 62 showed significant downtrends. Of 289 stations tested for trends in transport rate, 62 showed significant downtrends and only 23 showed significant uptrends. Trend tests on flow-adjusted concentrations were quite different from trend tests on unadjusted concentration data; 45 stations showed significant downtrends and 40 showed significant uptrends. (USGS)
W83-00126

HYDROGEOLOGY AND RESULTS OF INJECTION TESTS AT WASTE-INJECTION TEST SITES IN PINELLAS COUNTY, FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
J. J. Hickey.
Available from Supt. of Documents, GPO, Washington, DC 20402, Price, $6.00. Water-Supply Paper 2183, 1982. 42 p, 32 Fig, 8 Tab, 34 Ref.

Descriptors: *Injection wells, *Groundwater, *Water quality, *Waste disposal wells, Path of pollutants, Carbonate rocks, Aquifer characteristics, Groundwater movement, Chemical properties, Water analysis, Evaluation, *Florida, Pinellas County, Floridan aquifer.

In cooperation with Pinellas County, Fla., and the city of St. Petersburg, the U.S. Geological Survey undertook an evaluation of subsurface injection of wastewater. The injection sites are underlain by carbonate rocks. Lower Eocene rocks were penetrated and had relatively low water yields. The most productive rocks penetrated were of middle Eocene age within the Floridan aquifer. The aquifer was subdivided into four permeable zones and three semiconfining beds. The test injection zone has a transmissivity estimated to be about 1,000,000 feet squared per day. Parts of the zone are intensely shattered. Saltwater flow is probably occurring within the zone. Two semiconfining beds are above and have vertical hydraulic conductivities estimated to range from about 0.1 to 1 foot per day. Limited fresh ground water is in the Floridan aquifer at the test sites. Chloride concentration of native water in the injection zone ranges from 19,000 to 20,000 milligrams per liter. Injection tests from 3 to 91.1 days were run at three sites. Pressure buildup close to and at some distance from the test wells was typically less than 1 pound per square inch. The injected water was well mixed with formation water as a consequence of the fractured nature of the injection zone. (USGS)
W83-00129

SEASONAL CHANGES OF DISSOLVED SODIUM IN THE CONNECTICUT RIVER NEAR NORTHFIELD, MASSACHUSETTS,
Massachusetts Univ., Amherst. School of Health Sciences.
G. A. Kane, and E. J. Calabrese.
Journal of the New England Water Works Association, Vol 96, No 2, p 127-134, 1982. 4 Fig, 11 Ref.

Descriptors: *Sodium, *Salt, *Drinking water, Pollutant identification, *Connecticut River, Quabbin Reservoir, Northfield, *Massachusetts, Rivers, Diversion, Deicers, Reservoirs, Seasonal variation, Water analysis, Water pollution sources.

Sodium levels were determined from July 1979 to May 1980 at 4 stations in the Connecticut River near Northfield, Massachusetts. Public concern about the water quality in the river developed when a diversion to the Quabbin Reservoir, Boston's drinking water supply, was proposed. Application of salt in winter to highways paralleling the river posed a threat of salt contamination of the river. Annual average dissolved sodium at the 4 stations was 4-9 mg per liter, mean 5.6 mg per liter. The major peak, 6-9 mg per liter, was in July, with a minor peak, 6-7 mg per liter, in February. There were no significant differences along the 47.5 mile distance between stations. Comparison with Na concentration data from 1961-62, 1964-65, and 1966-67 showed that Na levels have not noticeably changed. Sodium levels found in this potential drinking water source are not considered a health hazard. (Cassar-FRC)
W83-00139

MULTIPLE PURGE TECHNIQUES FOR DETERMINING ORGANIC POLLUTANTS IN GROUNDWATER,
Connecticut Agricultural Experiment Station, New Haven.
For primary bibliographic entry see Field 5A.
W83-00158

ASSOCIATION STUDIES OF POLYBROMINATED BIPHENYLS IN AQUATIC SYSTEMS,
Michigan Univ., Ann Arbor. Dept. of Environmental and Industrial Health.
M. S. Simmons, and K. T. Kotz.
Bulletin of Environmental Contamination and Toxicology, Vol 29, No 1, p 58-63, 1982. 4 Tab, 10 Ref.

Descriptors: *Polybrominated biphenyls, *Adsorption, *Sediments, Organic carbon, Natural waters, Lakes, Rivers, Water, Water pollution effects, Water sampling, Sampling, Kinetics, Humic acid, *Lake Michigan, *Huron River.

Factors that determine the mode of action of polybrominated biphenyls (PBB), their movement through the water column and deposition and adsorption onto sediments were studied. The influence of the organic content of the sediment and the influence of the overlying water on the adsorption process were investigated. Sediments and overlying waters were sampled in Lake Michigan and the Huron River using ponar grab and Kemmerer samplers. Kinetic studies were performed in a closed reactor system for both distilled and natural water/sediment systems. Adsorption isotherm experiments were also performed. During kinetic studies, relationships of the TOC of water to the adsorptive capacity of the BR-2 sediment was investigted by addition of varying amounts of humic acid to water. Results indicated that the TOC of water will decrease the adsorption of PBB onto the sediment. (Small-FRC)
W83-00160

CHARACTERIZATION OF ORGANIC CONTAMINANTS IN ENVIRONMENTAL SAMPLES ASSOCIATED WITH MOUNT ST. HELENS 1980 VOLCANIC ERUPTION,
Geological Survey, Denver, CO.; and Bureau of Reclamation, Denver, CO. Denver Federal Center.
For primary bibliographic entry see Field 5A.
W83-00161

WATER CHARACTERISTICS,
Construction Engineering Research Lab. (Army), Champaign, IL.
E. D. Smith.
Journal of the Water Pollution Control Federation (Literature Review Issue), Vol 54, No 6, p 541-554, June, 1982. 174 Ref.

Descriptors: *Literature reviews, *Water quality, *Water pollution effects, *Fate of pollutants, *Re-

views, Acid rain, Snowmelt, Water pollution sources, Pollutant identification, Color, Odors, Taste, Optical properties, Water temperature, Dissolved oxygen, Suspended solids, Suspended sediment, Turbidity, Adsorption, Salinity, Dissolved solids, Acidity, Alkalinity, Hardness, Oxidation-reduction potential, Carbon dioxide, Public health.

Acid rain, color, odor, taste, optical properties, temperature, dissolved oxygen, suspended solids, salinity and dissolved solids, and radioactivity were among the water quality parameters reviewed with reference to 1981 research. A large amount of research was published on acid precipitation and its effects. Methods for simple determination of color in water were developed, and methods of removing color from water were presented. Odor sources in reservoirs were identified as microorganisms and algal blooms. Optical properties of pure water and of water bodies were handled in several papers. Topics concerning dissolved oxygen included stream reaeration models, causes of fishkills, and oxygen depletion. Many analytical techniques for measuring sediments were developed. Adsorption and release of pollutants on sediments and sediment transport were discussed. Effects and methods for determining salinity and dissolved solids were actively studied. The interrelated parameters of acidity, alkalinity, hardness, redox potential, and pH, were the subjects of papers on analytical determination, relationship to health effects, effects on aquatic organisms, carbon dioxide emissions to the atmosphere, and interaction with phytoplankton. Papers on radio activity were numerous. (Cassar-FRC)
W83-00169

TRACING WELL WATER POLLUTION IN A LIMESTONE AQUIFER,
Engineering Technology, Inc., New Orleans, LA.
C. P. Thomas, and S. Beckford.
Journal of the American Water Works Association, Vol 74, No 4, p 182-187, April, 1982. 2 Fig, 2 Tab, 6 Ref.

Descriptors: *Groundwater pollution, *Groundwater movement, Aquifers, Dye releases, Tracers, Wells, Wastewater, Runoff, Surface runoff, Agricultural runoff, Industrial wastewater, Fate of pollutants, Jamaica.

Water from wells is one of the safest and least expensive ways of meeting drinking water needs in Jamaica. A major aquifer located in the Queen of Spains Valley is the principal source of water for domestic, commercial, and industrial uses in northwestern Jamaica. Periodic occurrences of high turbidity and coliform levels in the first well tapping this aquifer prompted an investigation of possible sources of the pollution and of the movement of pollution in the wellfield. A total of 65 major sinkholes, which are the most important drainage feature of this high rainfall area, were found within a 1,500 meter radius of the five domestic water supply wells. Dye-tracing studies were conducted to determine the underground flow directions and travel times of the sugar factory wastewater discharge and of surface runoff through a sinkhole that drains a large sugar cane cultivation area. Both of the dye-tracer studies provided information about the movement of pollution which could threaten the planned development of wells. The surface runoff test showed that local runoff in the area of the wellfield is likely to feed directly into the aquifer and that the conditions for this occurrence exist. There was also a definite connection between the waste stream from the sugar factory and a nearby surface stream, Tom Spring. This wastewater stream appears to flow along a well-defined subsurface course which is not connected to the well, so the water quality at the wells is not affected. These tests indicate that water quality problems in the wells are caused by surface runoff during periods of heavy rainfall which transports high sediment loads into the aquifer through sinkholes. This type of siting investigation should precede location of new wells in this aquifer in order to minimize or eliminate pollution problems. (Carroll-FRC)
W83-00173

TRANSPORT OF ORGANIC CARBON TO THE OCEANS BY RIVERS OF NORTH AMERICA: A SYNTHESIS OF EXISTING DATA,
Oak Ridge National Lab., TN. Environmental Sciences Div.
P. J. Mulholland, and J. A. Watts.
Tellus, Vol 34, No 2, p 176-186, April, 1982. 3 Fig, 3 Tab, 31 Ref.

Descriptors: *Organic carbon, *Rivers, *Carbon cycle, Runoff, *North America, Sediment transport, *Path of pollutants, Streamflow.

Riverflow and organic carbon concentration data from 82 North American rivers draining about 60% of Canada and the United States were compiled and analyzed in an effort to estimate the transport of organic carbon in rivers of North America to the oceans. Data used in the study were collected by the U.S. Geological Survey and by the Water Resources Branch of the Canadian Inland Waters Directorate. While annual specific export of total organic carbon ranged from about 0.01 to 8.4 grams of carbon per square meter per year, the mean annual total organic carbon concentrations showed considerably less variation, ranging from 1.6 to 21.2 grams of carbon per cubic meter. Regional variation in annual specific export of total organic carbon was attributed primarily to differences in annual runoff. Computations of mean regional total organic carbon exports from the rivers surveyed were used to calculate the total export from the North American continent by rivers. Total organic carbon exports were estimated to be 37 times 10 to the 12th power grams of carbon in 1977 and 34 times 10 to the 12th power grams of carbon in 1978. Most of this loss was from the eastern and northwestern portions of the continent, where annual runoff was greatest. Riverflows during 1977 were compared with long-term annual averages for rivers in each region in order to estimate the total organic carbon export associated with long-term average riverflow. These computation indicated that the total organic carbon flux to the oceans associated with the long-term average annual flow in North American rivers is about 40 times 10 to the 12th power grams of carbon per year. This slightly higher figure is due to the lower than average runoff experienced in some regions in 1977 and 1978. (Carroll-FRC)
W83-00174

PHOSPHATE AND WIND IN A SHALLOW LAKE,
Center for Environmental Studies, Leiden (Netherlands).
W. T. De Groot.
Archiv fur Hydrobiologie, Vol 91, No 4, p 475-489, July, 1981. 5 Fig, 3 Tab, 7 Ref.

Descriptors: *Phosphates, *Eutrophic lakes, *Turbulent flow, *Wind velocity, *Lake Westeinder, *Water quality control, Lake restoration, Statistical analysis, *The Netherlands, Mathematical models, Lakes, Phosphorus, Nutrients, Mathematical studies, Phosphorus removal, Cycling nutrients, Lake sediments, Model studies, Wind.

A statistical analysis is described in which the monthly net phosphate exchange between sediment and supernatant water is the dependent variable. The analysis is based upon 28 monthly phosphate balances of the shallow eutrophic Dutch lake, Lake Westeinder. It emphasizes dataset building and the underlying causal hypothesis. The internal phosphate loadings of the lake are significantly correlated with the gross external loading and differences between two-day averages of wind velocities (rising wind induces higher phosphate concentrations) and differences between two-month averages of wind velocities (rising wind induces lower phosphate concentrations). These findings may aid in the distinction of longer and shorter term phosphate level changes and help to interpret the long term effects of wind and turbulence on the phosphate cycle when designing phosphate control measures. (Geiger-FRC)
W83-00184

THE CHEMISTRY AND PHYTOPLANKTON OF THE ORINOCO AND CARONI RIVERS, VENEZUELA,
Colorado Univ., Boulder. Dept. of Environmental, Population and Organismic.
W. M. Lewis,Jr., and F. Weibezahn.
Archiv fur Hydrobiologie, Vol 91, No 4, p 521-528, July, 1981. 2 Fig, 4 Tab, 17 Ref.

Descriptors: *Tropical regions, Rivers, *Chemical properties, *Phytoplankton, Ions, Cations, Anions, Phosphorus, Nitrogen, Nitrates, Carbon, Carbonates, Chlorides, Acidity, Sodium, Calcium, Potassium, Magnesium, *Venezuela, *Orinoco River, *Caroni River.

The chemistry of the major tropical rivers of the world is of interest as an indicator of the chemical mass balance of tropical regions. Chemical and microscopic studies were conducted on water samples of the Orinoco and Caroni Rivers with special focus on nitrogen, phosphorus, and carbon and phytoplankton communities. The Orinoco at Ciudad Bolivar was slightly acidic, of low ionic content and contained a relative abundance of calcium, sodium, potassium and magnesium cations and bicarbonate, sulfate and chloride anions. The Caroni at Puerto Ordaz was more acidic and had a much lower ionic content, with greater relative amounts of sodium and chloride ions. In both rivers, phosphorus in all forms was present in very small amounts. While particulates were very poor in nitrogen, both rivers displayed a high nitrate content. The particulates, which were very abundant in the Orinoco, were mostly clastic materials. The Caroni particulates contained a lower proportion of clastic materials. Living organisms in both rivers were extremely rare. (Geiger-FRC)
W83-00187

STRUCTURAL CHARACTERIZATION OF AQUATIC HUMIC MATERIAL,
North Carolina Univ. at Chapel Hill. Dept. of Environmental Sciences and Engineering.
For primary bibliographic entry see Field 5C.
W83-00190

MINERALIZATION OF LINEAR ALCOHOL ETHOXYLATES AND LINEAR ALCOHOL ETHOXY SULFATES AT TRACE CONCENTRATIONS IN ESTUARINE WATER,
Procter and Gamble Co., Cincinnati, OH. Environmental Safety Dept.
R. D. Vashon, and B. S. Schwab.
Environmental Science and Technology, Vol 16, No 7, p 433-436, July, 1982. 5 Fig, 1 Tab, 18 Ref.

Descriptors: *Surfactants, *Mineralization, *Kinetics, Fate of pollutants, *Detergents, Estuarine enviornment, Saline water, Decomposition, Degradation, Biodegradation, Trace levels, *Florida, *Escambia Bay.

Mineralization (ultimate biodegradation) of trace concentrations of linear alcohol ethoxylates (LAE), nonionic surfactants, and linear alcohol ethoxy sulfates (LAES), anionic surfactants, was rapid and extensive in estuarine water. The water samples were obtained from Escambia Bay, Florida, and had salinity of 28 o/oo. The studies used 4 pure chain length materials (C16 with 3 ethoxylates, C12 with 9 ethoxylates, C16 with 9 ethoxylates and sulfate, C16 with 3 ethoxylates and sulfate) labeled either at the alpha-alkyl carbon or uniformly in the ethoxylate chain. Kinetics of mineralization of the alpha-carbon were first-order over the concentration range 850 ng per liter of 140 micrograms per liter with a half-life of 2.1 days for the alpha-alkyl carbon. Kinetics of mineralization of the ethoxylate C were also first-order at a concentration of 1 microgram per liter or less of LAE or LAES, with a half-life of 6.3 days. At high concentrations the mineralization kinetics were linear or sigmoidal. The sulfate moiety of LAES had no effect on mineralization of either alkyl or ethoxylate C. There was no threshold concentration below which the compounds did not degrade down to the lowest initial concentration tested, 7.9 times 10 to the minus 10th power M. (Cassar-FRC)
W83-00211

HEAVY METAL INTERACTIONS AND DYNAMICS IN SIMULATED NAUGATUCK RIVER MICROCOSMS,
Connecticut Univ., Storrs. Dept. of Civil Engineering.
A. J. Medine, and M. F. Conway.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-108241. May, 1982, 70 p, 15 Fig, 8 Tab, 74 Ref, 1 Append. OWRT A-087-CONN(1), OWRT 14-34-0001-0107.

Descriptors: Chromium, Zinc, Iron, Ecosystems, *Lake Sediments, *Sediment-Water Interactions, *Aquatic Microcosms, Toxicity, *Naugatuck River, Chemical Equilibrium, *Heavy metals, *Connecticut, Water pollution sources, Water pollution effects.

The sediment-water interactions of heavy metals in the Naugatuck River in Summit Impoundment, a small mainstem reservoir north of Waterbury, were investigated through field studies and laboratory experiments using Three Phase Aquatic Microcosms (TPAM). Results of the study indicated high levels of NH sub 3, TOC, P, Fe, Cu, Zn and Total Cr were common in this stretch of the river. A significant reduction of highly toxic Cr (VI) was observed in Summit Impoundment and also verified in TPAM research. The high rate of Cr (VI) reduction appeared directly correlated with high concentrations of reduced aqueous species, i.e. Fe super 2+, HS super -, reduced organics, NH sub 3, and indirectly related to dissolved 0 sub 2. Oxygen levels greater than 2-4 mg/1 would tend to suppress Cr(VI) reduction to Cr(III). Once reduced, Cr was rapidly removed from the water column by precipitation of insoluble Cr(OH) sub 3 or sorption of positive Cr(III) species by the sediments. Cr(III) oxidation was not significant with an observed rate of 1 ug/1-day. Zinc dynamics indicated a very high rate of Zn removal by sediments to levels approximated by solid phase equilibria. Due to the essentially complete reduction of Cr(VI), no toxic effect was observed upon benthic respiration. The results indicated the natural ability of the Summit Impoundment (and other impoundments) to attenuate concentrations of heavy metals in the Naugatuck River, particularly the redox active species, Cr, Cu, and Fe. Replication of experimental units in the TPAM study was found to be excellent on the water quality parameters measured, including trace levels of metals, and would suggest the usefulness of the technique in other water quality studies.
W83-00214

MICROORGANISMS CAPABLE OF DEGRADING REFRACTORY HYDROCARBONS IN OHIO WATERS,
Dayton Univ., OH. Dept. of Microbiology.
J. J. Cooney.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-108290, Price codes: A04 in paper copy, A01 in microfiche. Ohio Water Resources Center, Columbus, Report No 493X, December 1980. 65 p, 5 Fig, 11 Tab, 81 Ref. OWRT B-060-OHIO(1).

Descriptors: *Aliphatic hydrocarbons, *Organic compounds, *Microbial degradation, *Cultures, *Aquatic fungi, *Aquatic bacteria, Water quality, Sediment-water interfaces, Lakes, Hydrocarbons, Metabolism, Biotransformation, Organic matter, Biodegradation, Degradation, Decomposition, Chemical wastes, Chemical degradation, Organic carbon, Bacteria, *Ohio.

Research was carried out to assess the degradation of model recalcitrant hydrocarbons (RH) by freshwater ecosystem microorganisms, the emulsification and metabolism of hydrocarbons by such bacteria, and factors influencing hydrocarbon degradation in three Ohio freshwater lakes. Pristane, 1,13-tetradecadiene (TDD), cyclohexane, and benzene were used as RH models. Pristane was degraded in 14 of 35 water-sediment cultures by 5 of 21 bacteria and 11 of 14 fungi, indicating there are individual freshwater organisms which can degrade branched hydrocarbons. TDD was degraded in 22 of 35 water-sediment cultures by 3 of 14 fungi and none of 21 bacteria, indicating individual freshwater organisms and combinations of such can degrade unsaturated hydrocarbons. Of 35 pure cultures, only one degraded benzene, while none degraded cyclohexane. Of 3 methods used to quantify emulsifying capacity, agitation followed by visual inspection gave the best results. Hydrocarbon appeared to induce emulsifier formation in 96% of 129 cultures isolated from freshwater lakes. A model is proposed for the role of emulsifier (s) in hydrocarbon utilization. Hydrocarbon degradation was nutrient-limited in the 3-lake study, but the reason for this was not obvious. Mixed microflora of these lakes can degrade hydrocarbons. (Zielinski-MAXIMA)
W83-00219

THE EFFECTS OF THE DISPOSAL OF SEWAGE EFFLUENTS ON GROUNDWATER QUALITY IN THE UNITED KINGDOM,
Water Research Centre (England).
For primary bibliographic entry see Field 5E.
W83-00220

COLIFORM ATTACHMENT TO SUSPENDED PARTICLES IN STORMWATER,
Michigan Univ., Ann Arbor. School of Public Health.
J. E. Schillinger, and J. J. Gannon.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-108324, Price codes: A05 in paper copy, A01 in microfiche. Completion Report, January, 1982. 84 p, 16 Fig, 28 Tab, 131 Ref, 3 Append. OWRT A-111-MICH(1).

Descriptors: *Coliforms, *Suspended solids, *Stormwater, *Particulate matter, *Water quality, Bacteria, Microorganisms, Pathogens, Bacterial analysis, Water analysis, Sedimentation, Settling tanks, Filtration, Settling velocity, Storm runoff, Storm wastewater.

Fractional filtration and settling tests showed significant numbers of fecal coliforms (FC), Klebsiella sp. (KS) and Pseudomonas aeruginosa (PA) (15-30% of cells), to be associated with stormwater suspended particles. Most of these were associated with the 30-52 and greater-than 52 micron fractions. The percentages of total filtered microorganisms retained on the 30 and 52 micron screens were for FC, KS, PA, and gram negative bacteria (GNB) were 80, 75, 68, and 87%, respectively. While large particles settled rapidly, sufficient numbers of single bacteria or aggregates less than 5 microns remain (above 50% of cells) to contribute to waterborne pollution, even after a 4-hour settling time. Significant differences were noted between adsorption of FC (16%) and pathogens KS and PA (26%), and between those groups and total GNB (37%) by retention on greater than 5 micron screens. Clay flocculation tests confirmed the lower adsorption/attachment rate of FC (E. coli used in lab tests), as observed in filtration and settling experiments; FC may not be ideal indicators of adsorption/settleability, but should be viewed as conservation indicators since other bacteria/pathogens may be more associated with suspended particles. (Zielinski-MAXIMA)
W83-00224

NITRATE CONTAMINATION OF GROUNDWATER ON THE OLD MISSION PENINSULA: CONTRIBUTION OF LAND RESHAPING AND SEPTIC DRAINFIELDS,
Michigan State Univ., East Lansing. Dept. of Crop and Soil Science.
B. G. Ellis.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-108340, Price codes: A03 in paper copy, A01 in microfiche. Completion Report, March 1982. 33 p, 2 Fig, 17 Tab, 12 Ref, 1 Append. OWRT A-119-MICH(1), 14-34-0001-1124.

Descriptors: *Nitrates, *Groundwater pollution, *Land forming, *Drainage effects, *Water quality standards, Land development, Subsurface drainage, Groundwater, Land use, Landscaping, Terracing, Septic sludge, Septic wastewater, Drainage water, Catchment areas, Drinking water, Soil porosity.

Research was carried out to determine the concentration of nitrate nitrogen in the soil with depth as affected by reshaping land surfaces, as well as its concentration leading from septic drainfields, in order to examine the movement of nitrate through soils as a result of reshaping soil surfaces and using septic drainfields. In both cases, nitrate values exceeding the drinking water standard were observed. However, the nitrate increases as a result of land reshaping were not considered to be a major source of groundwater contamination, since, in the worst case (heavy fill of top soil to a depth of 10 feet or more) nitrate should decrease with time. Septic systems were found to give 20-40 ppm nitrate nitrogen during all seasons of the year, which is 2-4 times the drinking water standard. This is expected to represent a serious contamination source, since it is not expected to be diluted by more than about half for the lot sizes in many of the Peninsula subdivisions. It may also become more of a problem in the future as nitrate content in the well water begins to rise. Nitrate nitrogen in deep profile soil samples (for reshaped land) and samples from lysimeters (for septic drainfields) was extracted, reduced to nitrite, and analyzed colorimetrically on an automatic analyzer. (Zielinski-MAXIMA)
W83-00228

PRACTICAL TECHNIQUES OF RIVER MONITORING AND POLLUTION FORECASTING,
Institute of Hydrology, Wallingford (England).
D. E. Caddy, and P. G. Whitehead.
Effluent and Water Treatment Journal, Vol 22, No 5, p 179-182, May, 1982. 4 Fig, 3 Tab, 5 Ref.

Descriptors: *Monitoring, *Forecasting, *Computers, Water pollution effects, Model studies, Telemetry, Remote sensing, Water pollution sources, Industrial wastes, Wastewater disposal.

The water quality monitoring and telemetry system established on the Bedford Ouse River System is described. An integral part of that system is the micro-computer based in Cambridge and used as a central processor to telephone the outstations, receive and store data and forecast water quality. The package of computer programs developed for the micro-computer provides a flexible system with which to monitor and forecast water quality conditions on the Bedford Ouse. The development of relatively cheap and reliable micro-computers has enhanced the capabilities of such systems, providing information of significant operational value to management. With the need to save capital resources in the future it is necessary to ensure good operational control of water quality in river systems, particularly along critical stretches of river such as the Bedford Ouse. The monitoring and forecasting scheme is one method of ensuring that the best information is available for management. The model developed for the Ouse is an operational one and is therefore designed to use time varying input measures of flow and water quality to compute time varying output responses. The model characterizes the short term system behavior and provides a mathematical approximation to the physicochemical changes in the river system. In one case of the Milton Keynes effluent the model provided valuable information for the management at the Clapham water abstraction plant and gave them effectively a four day warning. A second case study relates to the release of an unsatisfactory effluent from Bedford sewage works, which resulted in a significant pulse of ammonia being discharged to the river. (Baker-FRC)
W83-00238

NON-POINT POLLUTION CONTROL FOR RANGELAND WINTERING, LIVESTOCK OPERATIONS (GROUND COVER),
Idaho Univ., Moscow. Coll. of Engineering.
For primary bibliographic entry see Field 5G.
W83-00252

NITRATE MOVEMENT AND DENITRIFICATION DEFINED RELATIVE TO BROMIDE TRACER IN TILE-DRAINED LAND,

Iowa State Water Resources Research Inst., Ames.
J. L. Baker, H. P. Johnson, T. Fenton, J. O'Toole, and T. Grauer.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-108035, Price codes: A07 in paper copy, A01 in microfiche. Completion Report ISWRRI-115, June, 1982. 118 p, 13 Fig, 19 Tab, 48 Ref, 3 Append. OWRT A-055-IA(1), 14-31-0001-5015.

Descriptors: *Denitrification, *Environmental tracers, *Bromides, *Soil water, *Tile drainage, Tracers, Nitrates, Nitrogen cycle, Nitrogen, Nitrogen removal, Tagging, Leaching, Infiltration, Percolation, Tile drains, Nutrients, Nutrient removal.

A 3-year field experiment initiated in 1975 was designed to study the movement of nitrogen (N) as nitrate (N03) and bromide (Br) through the soil profile and into tile lines, following application of N fertilizer and ammonium bromide. The study was carried out to assess the N03 leaching rate from the soil surface to the tile drains, to test the use of Br ion as a tracer, and to use the data to estimate the relevance of N transformation (e.g., mineralization; denitrification (DN), in the fate pathways of N. Tile drain water concentrations of both N03 and Br approached maximum nearly a year after fertilizer and bromide application (42 and 12 mg/liter, respectively); in this interval, about 325 mm water had flowed from the tile drains. Ratios of N03/Br in tile drainage water decreased from 4.7-2.5 and from 2.5-0.26 for the two tiles used during a 14-month dry period. The decrease in N03 levels and in N03/Br ratios with time was interpreted as being due to DN. These ratios also decreased in soil and soil water samples with time, also suggesting DN. Chemical balance for N03 and leach loss data were obtained. Since no plant uptake of N occurred in the fallow study area, DN of N03 appeared to be at least 200 kg/ha (of 390 kg/ha present following chemical application). (Zielinski-MAXIMA)
W83-00264

A PRELIMINARY STUDY OF NATURAL AQUIFER DISCHARGE OF GUAM,
Guam Univ., Agana. Water and Energy Research Inst. of the Western Pacific.
W. J. Zolan.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-108100, Price codes: A03 in paper copy, A01 in microfiche. Technical Report No 34, August, 1982. 47 p, 7 Fig, 2 Tab, 14 Ref, 4 Append. OWRT A-022-GUAM(1), 14-34-0001-1112.

Descriptors: *Groundwater movement, *Groundwater pollution, *Guam, *Aquifer characteristics, *Water analysis, Natural flow, Natural resources, Natural streams, Aquifers, Seawater, Groundwater depletion, Water sampling, Nutrients, Nitrates, Chlorophyll, Coliforms.

The quality of groundwater seeps along the northern coast of Guam was studied to ascertain the presence of major regional differences. Water samples were collected and analyzed bimonthly over an 8-month period from groundwater seepage, springs, three caves, and an open sink hole. Marine waters about 5 m outward were analyzed for inorganic nutrients, chlorophylls a/b/c, and carotenoids. Results indicated that shoreline seepage averages 6-7% seawater, based on chloride and sulfate concentrations, while larger springs have 2-3% seawater. Caves and the sink hole averaged 3% seawater. Thus, very little dilution with seawater occurs prior to groundwater discharge at the surface. Nitrate-nitrogen NO3-N) levels are in the same range as most well groundwater (1-2 mg/liter NO3-N). Other inorganic nutrients (ammonia- and nitrite-nitrogen, and phosphate-phosphorus) were also similar to typical groundwater levels. Further, coliform bacteria were few/zero in almost all samples. Marine water adjacent to groundwater seepage areas had higher chlorophyll (chlorophyll a averaged 1.0 mg/cu m) and caroteniods than waters in the same area removed from shore. Nutrient levels (especially NO3-N) often exceeded the established water quality standard (0.20 mg/liter for NO3-N). Shoreline seeps at three points had the greatest variability due to the effect of tidal height and surf condition differences; other sampling stations gave more consistent results. (Zielinski-MAXIMA)
W83-00271

THE FLOW OF SLURRY FROM A BREACHED TAILINGS DAM,
University of the Witwatersrand, Johannesburg (South Africa). Dept. of Construction Materials.
For primary bibliographic entry see Field 8B.
W83-00285

PERSISTENCE IN MODEL ECOSYSTEMS,
Georgia Univ., Athens. Dept. of Mathematics.
T. C. Gard.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-196916, Price codes: A02 in paper copy, A01 in microfiche. Environmental Protection Agency Project Summary EPA-600/S3-82-030, May 1982. 2 p.

Descriptors: *Ecosystems, *Mathematical models, *Fate of pollutants, *Persistence, Water pollution effects, Nutrients, Food chains, Toxic substances.

Mathematical models aid in understanding environmental systems and in developing testable hypotheses relevant to the fate and ecological effects of toxic substances in such systems. Within the framework of microcosm or laboratory ecosystem modeling, some differential equation models, in particular, become tractable to mathematical analysis when the focus is on the problem of persistence. In this report, a hierarchy of microcosm-related models, the top level of which contains a nutrient-producer-grazer food chain, and general food chains are analyzed for persistence. The results, which take the form of inequalities involving model parameters, specify necessary conditions and sufficient conditions for continued presence of the model components throughout indefinite time intervals. These results can serve as a basis for preliminary evaluations of model performance. (Author's abstract)
W83-00294

STREAM WATER NUTRIENT CHANGES ASSOCIATED WITH THE CONVERSION OF ARIZONA CHAPARRAL,
Rocky Mountain Forest and Range Experiment Station, Tempe, AZ.
E. A. Davis.
In: Proceedings of the Symposium on Dynamics and Management of Mediterranean-Type Ecosystems, June 22-26, 1981, San Diego, California, Pacific Southwest Forest and Range Experiment Station General Technical Report PSW-58, 1982, p 333-338, 3 Tab, 4 Ref.

Descriptors: *Nitrates, *Chaparral, *Brush control, *Water yield improvement, *Water pollution sources, Nutrients, Herbicides, Leaching, Vegetation, Grasslands, Eutrophication, Watershed management, *Arizona.

Streamflow from chaparral watersheds in Arizona can be increased under certain conditions by converting brush to grass. This increased streamflow is associated with increased nitrate concentrations in the stream water. Undisturbed chaparral watersheds are tight with respect to nitrogen, losing very little nitrate-nitrogen in streamflow; nitrate concentrations are usually less than 0.5 ppm. Converting chaparral watersheds from deep-rooted shrubs to shallow-rooted grasses through the use of herbicides allows the escape of nitrate ions through the soil mantle. Nitrate concentrations of 45-80 ppm occurred in stream water from treated watersheds; nitrate concentrations remained above normal for 10 years or more. For the first few years, the pattern of nitrate concentration followed a wave form in which nitrate increased only after rainstorms of sufficient duration and amount to leach nitrates through the regolith into base flow. During the second stage, nitrate concentrations in the stream water remained 10 to 100 times above normal, with rainfall conditions adequate to sustain increased water yields. Some possible effects of the nitrate-release phenomenon are eutrophication of streams and reservoirs, loss of watershed soil fertility, and unsuitability of stream water for drinking purposes. (Moore-SRC)
W83-00300

INFLUENCE OF PRESCRIBED BURNING ON NUTRIENT BUDGETS OF MOUNTAIN FYNBOS CATCHMENTS IN THE S. W. CAPE, REP. OF SOUTH AFRICA,
Jonkershoek Forest Research Station, Stellenbosch (South Africa).
D. B. Van Wyk.
In: Proceedings of the Symposium on Dynamics and Management of Mediterranean-Type Ecosystems, June 22-26, 1981, San Diego, California, Pacific Southwest Forest and Range Experiment Station General Technical Report PSW-58, 1982. p 390-396, 3 Fig, 5 Tab, 12 Ref.

Descriptors: *Prescribed burning, *Nutrients, *Precipitation, *Water quality, *Sediment load, *South Africa, Sodium, Chloride, Floods, Streams, Load management.

The nutrient budgets of the Western Cape Mountain fynbos areas of the Republic of South Africa have been the subject of investigations since 1971. The average nutrient input (120 kg/ha/yr) exceeds the output (96 kg/ha/yr) by 29%. Because in this case the main source of nutrients in precipitation is the sea, heavy loads of Na and Cl are deposited into the fynbos areas. The other constituents of precipitation are K, Ca, Mg, Cl. Traces of HC03 and S04 were found, while no traces of N and P were detected. The constituents in streamflow were present in the same ratio as in precipitation. The influence of prescribed burning in different seasons on stream water quality was also investigated. Results indicate that nutrient release as a result of prescribed burning does not persist beyond the first winter after burning. The month in which burning takes place has an influence in this respect. It was found that the net release of nutrients takes place during the first two floods after the burn. There is no marked increase in sediment loads of the streams after burning. (Author's abstract)
W83-00304

POLYCYCLIC AROMATIC HYDROCARBONS IN SEWAGE, MUSSELS AND TAP WATER,
Central Inst. for Industrial Research, Oslo (Norway).
K. Kveseth, B. Sortland, and T. Bokn.
Chemosphere, Vol 11, No 7, p 623-639, July, 1982. 5 Fig, 4 Tab, 22 Ref.

Descriptors: *Polycyclic aromatic hydrocarbons, *Drinking water, *Bioaccumulation, *Treated water, Water quality standards, Wastewater treatment, Mussels, Gas chromatography, Water pollution effects, Norway, Finland, Sweden.

Polycyclic aromatic hydrocarbon levels were determined in treated sewage water; in drinking water supplies from Norway, Finland, and Sweden; in mussels grown in polluted and unpolluted waters; and in Norwegian tap water. Glass capillary gas chromatograph y was used to identify up to 30 PAH compounds. PAH levels were below the standard recommended by WHO in all potable waters tested. The samples collected near a water treatment plant outlet in a rainwater collecting basin showed slightly higher levels. Sewage discharge water had concentrations of 0.8 to 7.7 micrograms/liter and tap water had 0.002 to 0.2 micrograms/liter. Mussels had concentrations from 0.5 to 1.1 micrograms/liter, and accumulation in mussels seemed to be rather slow. (Small-FRC)
W83-00330

THE FATE OF 2,4,6-TRICHLOROPHENOL IN AN AQUATIC CONTINUOUS-FLOW SYSTEM,
Jyvaskyla Univ. (Finland). Dept. of Cell Biology.
M. T. Virtanen, and M-L. Hattula.
Chemosphere, Vol 11, No 7, p 641-649, July, 1982. 2 Tab, 12 Ref.

Descriptors: *Toxicity, *Fish toxins, *2,4,6-Trichlorophenel, *Bioaccumulation, Hazardous materials, Sediment, Flora, Snails, Bleaching wastes,

Fish, Water pollution effects, Gas chromatography, Industrial wastes, *Finland, Teratogenesis, *Phenols.

The toxicity of 2,4,6-trichlorophenol (TCP) to fish was evaluated, and the bioaccumulation of 2,4,6-TCP in sediment and several aquatic organisms was studied. Gas chromatography was used to determine 2,4,6-TCP levels in oedogonium, echinodorus, elodea, lymnea, poecilia, and asellus kept in a flow-through glass aquarium where water contained 5 ppb TCP. Rapid take-up was observed in plants, snails, and fish. Young born to test fish had a high incidence of curvature of the spine and a high death rate. Thus, TCP may be a potent teratogen. 2,4,6-TCP is a typical residue from chlorine bleaching and is contained in wood preservatives. (Small-FRC)
W83-00332

5C. Effects Of Pollution

MUNICIPAL POINT SOURCE AND AGRICULTURAL NONPOINT SOURCE CONTRIBUTION TO COASTAL EUTROPHICATION,
Tennessee Valley Authority, Knoxville, TN.
For primary bibliographic entry see Field 5B.
W83-00001

AEROBIC DEGRADATION OF DIURON BY AQUATIC MICROORGANISMS,
Clemson Univ., SC. Dept. of Microbiology.
For primary bibliographic entry see Field 5B.
W83-00002

CONTROL OF LAKE PHOSPHORUS WITH ALUMINUM SULFATE: DOSE DETERMINATION AND APPLICATION TECHNIQUES,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Lab.
R. H. Kennedy, and G. D. Cooke.
Water Resources Bulletin, Vol 18, No 3, p 389-395, June, 1982. 6 Fig, 1 Tab, 30 Ref.

Descriptors: *Phosphorus removal, *Lake sediments, *Eutrophic lakes, *Nuisance algae, *Aluminum sulfate, Phosphorus, Chemical precipitation, Lakes, Reservoirs, Water quality control, Eutrophication, Turbidity, Nutrients, Nutrient removal, Cycling nutrients.

Some types of lakes and reservoirs will experience nuisance algal blooms despite nutrient diversion due to recycling of phosphorus (P) from sediments. In order to control P release from sediments and remove P from the water column, the P precipitation/inactivation technique using aluminum sulfate may be applied. A method for calculating the proper aluminum dose is suggested which emphasizes long term control of P recycling from bottom sediments. The dose can be calculated directly from water alkalinity and a scale for alum applications to lakes and reservoirs can be established by titration of water samples of varying alkalinity. Application methods and equipment vary with treatment objectives and include lakeside storage, a distribution pipe, and an application barge and manifold. Alum treatment may also be employed to handle problem flows and reduce particulate concentrations and lake turbidity. (Geiger-FRC)
W83-00006

MASS BALANCE MODEL ESTIMATION OF PHOSPHORUS CONCENTRATIONS IN RESERVOIRS,
Bureau of Reclamation, Denver, CO. Engineering Research Center.
D. K. Mueller.
Water Resources Bulletin, Vol 18, No 3, p 377-382, June, 1982. 6 Fig, 7 Tab, 15 Ref.

Descriptors: *Water quality control, *Phosphorus, *Eutrophication, *Model studies, *Reservoirs, Mathematical models, Lakes, Water quality management, Artificial lakes, Nutrients, Mathematical studies.

Mass balance models are useful tools in the control of phosphorus induced eutrophication of lakes, but their applicability to reservoirs, especially those of the Western United States, has not yet been verified. Using data from the United States Environmental Protection Agency National Eutrophication Survey, such a verification was attempted for 68 reservoirs from 11 Western states. Several models commonly used in lake quality assessments were compared for accuracy in application to the reservoir data by model standard error and correlation between estimated and observed reservoir phosphorus concentrations. The model of Dillon and Rigler, which uses phosphorus retention calculated from observed data, proved the most accurate with a correlation coefficient of 0.86 and a standard error of 0.2, based on logarithmic transformed values. Other models considered included the Vollenweider-1975 model which assumes a constant settling velocity, the Jones-Bachmann model which assumes a constant sedimentation coefficient, the Dillon-Kirchner model which estimates phosphorus retention as a function of hydraulic load, and the Vollenweider-1976 model which estimates phosphorus flushing from the inverse of hydraulic detention. These models displayed deficiencies in model formulation and in coefficient adaptation to lake data. (Geiger-FRC)
W83-00009

THE INCIDENCE OF VIBRIO CHOLERAE IN WATER, ANIMALS AND BIRDS IN KENT, ENGLAND,
Preston Hall Hospital, Maidstone (England). Public Health Lab.
For primary bibliographic entry see Field 5B.
W83-00012

DISTRIBUTION OF DENITRIFYING BACTERIA AND ITS CONTROLLING FACTORS IN FRESHWATER ENVIRONMENTS,
Tokyo Metropolitan Univ. (Japan). Dept. of Biology.
T. Nakajima.
Japanese Journal of Limnology, Vol 43, No 1, p 17-26, January, 1982. 8 Fig, 1 Tab, 27 Ref.

Descriptors: *Bacteria, Natural waters, *Denitrification, Lakes, *Denitrifying bacteria, Rivers, *Japan, Pseudomonas, Eutrophication, Ponds, Stratification, Nitrogen removal, Limnology.

Factors affecting the distribution of denitrifying bacteria and the genera of these bacteria in freshwater environments are investigated. The water environments studied included Himon-ya Pond, located in a small metropolitan park in Tokyo with little inflow except rainwater; Lake Kasumigaura and Lake Kitaura with areas of 178 and 78.8 sq km, respectively; Lake Suwa with an area of 14.5 sq km and a maximum depth of 7 m; Lake Nakanuma, which is a small eutrophic lake surrounded with paddy fields; and the River Tamagawa, located at the southwest part of Tokyo. The three study sites on the River Tamagawa ranged from slightly polluted to heavily polluted with municipal sewage. The denitrifying bacterial population fluctuated greatly in both non-stratified and stratified eutrophic lake waters, although the aerobic heterotrophic bacteria varied little. In non-stratified eutrophic lakes the number of denitrifying bacteria tended to increase as the amount of total nitrogen in water increased. The amount of total nitrogen indicates the degree of lake eutrophication. In a stratified eutrophic lake the ratio of the number of denitrifying bacteria to that of aerobic heterotrophic bacteria (D/Aeh) tended to increase as the concentration of dissolved oxygen decreased. Denitrifying bacteria in both water and attached substances in a polluted river tended to increase in number with the increase in biochemical oxygen demand. The D/Aeh ratio in water and attached substances was higher than 0.01. Almost all denitrifying bacteria detected in the Himon-ya Pond, Lake Nakanuma and the River Tamagawa were gram-negative. Pseudomonas was the genus most frequently isolated from every water type and attached substance. (Baker-FRC)
W83-00018

OBSERVATIONS ON THE BIOACCUMULATION POTENTIAL OF THORIUM AND URANIUM IN RAINBOW TROUT (SALMO GAIRDNERI),
Pacific Northwest Lab., Richland, WA. Dept. of Ecological Sciences.
T. M. Poston.
Bulletin of Environmental Contamination and Toxicology, Vol 28, No 6, p 682-690, June, 1982. 1 Fig, 5 Tab, 12 Ref.

Descriptors: *Radioactive wastes, *Thorium, *Uranium, *Trout, *Bioaccumulation, Path of pollutants, Water pollution sources, Nuclear powerplants, Radioisotopes, Adsorption, Accumulation, Fish, Ecological effects, Powerplants.

The continued used of uranium (U) and the potential use of thorium (Th) as nuclear reactor fuels in powerplants may result in increased amounts of these actinides in aquatic ecosystems. A study was conducted to determine if uptake of U or Th occurs at significant rates in juvenile rainbow trout and to assess how soluble and particulate partitioning affects the uptake behavior of these actinides. Th rapidly partitioned into soluble and particulate fractions when mixed with Columbia River water, while all U measured in the water column represented the soluble fraction. Total body burdens of Th varied during both uptake and depuration but represented mostly either gut loading or surface adsorption of Th. Gut loading was also probably responsible for the wide variations in U body burdens during the uptake phase. At higher U concentrations, the actinide was incorporated into the tissue of the fish. Depuration results suggested that both Th and U become tissue bound, but most of the body burdens during uptake could be attributed to gut loading. Concentration ratios indicated a low propensity for Th and U accumulation in fish tissues. (Geiger-FRC)
W83-00021

A PRINCIPAL COMPONENTS ANALYSIS OF THE PHYTOPLANKTON FROM A POND IN THE PARANA RIVER VALLEY, ARGENTINA,
Instituto Nacional de Limnologia, Santo Tome (Argentina).
M. O. Garcia de Emiliani, and P. J. Depetris.
Hydrobiologia, Vol 89, No 2, p 117-122, April, 1982. 3 Fig, 1 Tab, 20 Ref.

Descriptors: *Ponds, *Multivariate analysis, *Phytoplankton, Physical properties, Biological properties, Chemical properties, Mathematical studies, Statistical analysis, Seasonal variation, Lotic environment, Lakes, Limnology, River basins, *Argentina, Parana River, Alluvial plains, Water level.

The present study represents the first study in a series evaluating the relative importance of ecological factors on selected ponds of the middle Parana alluvial plain. Multivariate statistical analyses were used to reveal the ecological factors that generate the variability observed in the 10 physical, chemical and biological (phytoplankton) parameters measured in Los Matadores pond. Samples were taken from the superficial layer of the pond's center. The parameters selected for study included depth, water temperature, pH, primary productivity, specific diversity, and the concentrations of nitrates, phosphates, silica, cells, and chlorophyll a. Results from 42 analyzed samples showed that 82.1% of the total variance in the data is accounted for by the first three components of the principal components analysis: the lotic influence (58.3% of the variance), the seasonal cycle (16.4%), and the degree of pond maturity (7.4%). (Geiger-FRC)
W83-00022

APPLICABILITY OF PHOSPHORUS BUDGET MODELS TO SOUTHERN AFRICAN MAN-MADE LAKES,
National Inst. for Water Research, Pretoria (South Africa). Limnology Div.
J. A. Thornton, and R. D. Walmsley.
Hydrobiologia, Vol 89, No 3, p 237-245, May, 1982. 4 Fig, 3 Tab, 45 Ref.

Descriptors: *Phosphorus, *Model studies, *Artificial lakes, *Eutrophication, Trophic level, Lakes, Mathematical models, Mathematical studies, Mu-

nicipal wastewater, Prediction, *South Africa, Retention, Catchments, Water management.

A study was made of the phosphorus (P) loading in 31 southern African man-made lakes that were characterized by low retention time (< 1 yr). Catchment P export rates varied widely from those of lakes subject to excessive inputs of municipal wastewaters having export rates of 53 milligrams/sq m/yr. The P data was tested against two P budget models for predicting in-lake steady state P concentrations. The Vollenweider eutrophication model (1976) relates the steady state in-lake P level to P loading and water retention time. The Dillon and Rigler model describes the steady state P level in a lake based on its P loading, flushing rate, mean depth, and P retention. Both models displayed good potential for predicting steady state P concentrations, but the Dillon and Rigler model gave slightly better results. In lakes where P levels are not necessarily related to trophic state, other models may be needed as predictive tools for eutrophication control. (Geiger-FRC)
W83-00025

EXISTENCE OF PHYTOPLANKTON IN SPIRIT LAKE NEAR ACTIVE VOLCANO MT. ST. HELENS, WASHINGTON, U.S.A.: POST-ERUPTION FINDINGS,
Army Engineer District, Portland, OR.
D. W. Larson, and N. S. Geiger.
Archiv fur Hydrobiologie, Vol 93, No 3, p 375-380, February, 1982. 1 Fig, 3 Tab, 16 Ref.

Descriptors: *Volcanoes, *Lake restoration, *Phytoplankton, *Spirit Lake, *Mt. St. Helens, *Washington, Diatoms, Water quality, Species composition, Algae, Water pollution effects, Lakes, Phosphorus, Nitrates, Limnology, Organic compounds.

Phytoplankton highly tolerant to adverse water conditions were present during August and October 1980 in Spirit Lake, which had been choked with volcanic debris and logs and heated to over 40C during the eruption of Mt. St. Helens, Washington, in May 1980. Thirteen species of diatoms were found during the October 21, 1980, sampling. Cyclotella stelligera accounted for 26% of the total density; Stephanodiscus astraea, 22%; Fragilaria construens, 17%; and Melosira distans, 8%. Total densities were 260,000 units per liter. Water quality in October was slightly improved over that observed in August, but was high in phenolics, 0.78 mg per liter. Specific conductivity was 679 micromhos per cm; temperature, 13C. In August color was 400 platinum cobalt units; total phosphorus, 0.26 mg per liter; dissolved oxygen, 0.45 mg per liter; and nitrate, 2 mg per liter. These findings suggest that lake recovery is underway in spite of the extreme perturbation. (Cassar-FRC)
W83-00026

PALEOECOLOGICAL STUDIES OF THE RECENT DEVELOPMENT OF THE LAKE VAXJOSJON. IV. INTERPRETATION OF THE EUTROPHICATION PROCESS THROUGH THE ANALYSIS OF SUBFOSSIL CHIRONOMIDS,
Uppsala Univ. (Sweden). Dept. of Entomology.
Y. Brodin.
Archiv fur Hydrobiologie, Vol 93, No 3, p 313-326, February, 1982. 2 Fig, 2 Tab, 33 Ref.

Descriptors: *Eutrophication, *Midges, Sediments, Water pollution effects, Eutrophic lakes, Lakes, Shallow water, Oxygen depletion, Lake Vaxjosjon, *Sweden, *Fossils, *Lake sediments, Organic matter, Benthic fauna, *Paleolimnology, Species distribution, Wind.

The eutrophication of shallow Lake Vaxjosjon, Sweden, was traced for 700 years through examination of subfossil littoral chironomid remains in a 2.5 m core taken from the deepest part of the lake. In general, the structure of the chironomid community depended on food availability and oxygen conditions. The first zone, below 170 cm depth, covered 500 years of moderate change, ending in 1814, when the lake level lowered. The second zone, 170-110 cm depth, represented increased erosion and human activity. Sediment from the third period, 1910-1965, was black as a result of culturally induced oxygen deficits. A total of 1476 head capsules were found in the core. They belonged to 31 genera and 50 species. Glyptotendipes and Cricotopus were most abundant, followed by Tanytarsus, Chironomus, and Polypedilum. The fauna associated with eutrophic conditions were found throughout the core, but 23 species were not found in the shallowest, most eutrophic zone 3. No taxa representing oligotrophic conditions were found in zone 3. Results indicated that the lake was already eutrophic in 1300 A. D. The increasing diversity and occurrence of polyoxybiontic species showed that oxygen conditions had improved in the sediments up to about 1800, probably from cutting the surrounding forest and opening the lake to wind action. Eutrophication increased markedly until 1930, as reflected in strong changes in the structure of the chironomid com the chironomid fauna indicated improved environmental conditions. (Cassar-FRC)
W83-00028

INDUCTION OF HIGH PHOSPHATASE ACTIVITY BY ALUMINUM IN ACID LAKES,
Uppsala Univ. (Sweden). Inst. of Limnology.
For primary bibliographic entry see Field 5B.
W83-00029

EFFECTS OF THE BURROWING MAYFLY, HEXAGENIA, ON NITROGEN AND SULFUR FRACTIONS IN LAKE SEDIMENT MICROCOSMS,
State Univ. of New York Coll. of Environmental Science and Forestry, Syracuse. Dept. of Environmental and Forest Biology.
G. B. Lawrence, M. J. Mitchell, and D. H. Landers.
Hydrobiologia, Vol 87, No 3, p 273-283, March, 1982. 7 Fig, 2 Tab, 30 Ref. OWRT B-096-NY.

Descriptors: *Mayflies, Sediments, *Nitrogen compounds, *Sulfur compounds, *Hexagenia, Metabolism, Invertebrates, *Lake sediments, Oxidation-reduction potential, Hydrogen ion concentration, Chemical reactions, Ammonia, Nitrates, Sulfates, Decomposition, Bioturbation, *New York, Deer Lake.

The effects of the burrowing mayfly, Hexagenia, on the chemistry (nitrogen and sulfur pools) of sediment and overlying water were determined in the laboratory. Of the 27 glass jars containing water and sediment from Deer Lake (Adirondacks), 9 had 2 live Hexagenia nymphs each, 9 had 2 dead Hexagenia each, and 9 had no animals added. In the live microcosms sediment redox potential (Eh) increased 1.98 + or - 0.486 mV per day, sediment pH decreased 0.007 + or - 0.001 per day, water pH decreased 0.024 + or - 0.004 per day, sediment ammonia increased 5.46 + or - 0.14 ppm N per day, and water ammonia increased 0.792 + or - 0.154 ppm N per day. There were no increases in the control Eh, pH, or ammonia concentrations. Water Eh increased 1.95 + or - 0.410 mV per day in all microcosms. Sediment nitrate increased 0.202 + or - 0.081 ppm N per day in the live microcosm, 0.017 + or - 0.05 ppm N per day in the control, and did not change in the dead microcosms. The sulfate fraction of the sediment (0.017 + or - 0.006% dry mass) and water (50.0 + or - 4.9 per liter) in Hexagenia microcosms was greater than in the control (0.151 + or - 0.005% dry mass and 14.7 + or - 1.71 mg per liter) at the end of the 54-day experiment. Zn-HCl reducible inorganic sulfur decreased in all microcosms, with the live environment showing the greatest decrease (7.1 + or - 1.5 S per day). There was a general increase in inorganic S and ester sulfate, 7.2 + or - 6.9 ppm S per day. In general the dead microcosms produced results similar to the control. Increased redox potential and decreased pH were a result of increased dissolved oxygen concentrations and metabolic activity. The rapid ammonia increase was a result of excretion by the nymphs, and the nitrate increases were due to nitrification of ammonia. (Cassar-FRC)
W83-00030

DISTRIBUTION OF CHIRONOMIDS IN THE LITTORAL ZONE OF LAKE TEXOMA, OKLAHOMA AND TEXAS,
Oklahoma Univ., Norman. Dept. of Zoology.
For primary bibliographic entry see Field 2H.
W83-00031

THE STRUCTURE AND SOME RECENT CHANGES OF THE ZOOBENTHIC COMMUNITY IN THE ERMATINGER BECKEN, A SHALLOW LITTORAL PART OF LAKE CONSTANCE,
Zululand Univ. (South Africa). Dept. of Botany.
For primary bibliographic entry see Field 2H.
W83-00036

THE RECENT HISTORIES OF THREE CANADIAN SHIELD LAKES: A PALEOLIMNOLOGICAL EXPERIMENT,
Queen's Univ., Kingston (Ontario). Dept. of Biology.
J. P. Smol, and M. D. Dickman.
Archiv fur Hydrobiologie, Vol 93, No 1, p 83-108, November, 1981. 14 Fig, 1 Tab, 44 Ref.

Descriptors: *Road construction, *Algae, *Paleolimnology, Water pollution effects, Found Lake, Jake Lake, Delano Lake, *Canada, Phytoplankton, Diatoms, Lakes, Turbidity, Sediments, Lake sediments, Nutrients, Limnology, Organic matter, Algonquin Provincial Park, Construction, Carbonates, *Shield lakes.

Paleolimnology was used to compare the effects of cultural disturbances in 3 small lakes with very small watersheds in Algonquin Provincial Park, Ontario. Found Lake and Jake Lake were subjected to the impacts of roadbuilding in 1933, followed by paving in 1948 and construction of a park museum in 1953. Delano Lake, relatively free of such influences, served as a control. The top 20 cm of the lake sediment was studied at 1 cm intervals for fossil diatoms, pollen grains, phosphorus, organic matter, and carbonate. As a result of increased water turbidity following road construction the diatom Synedra delicatissima var. angustissima increased in Found Lake, replacing the tychoplankton Cyclotella stelligera. The diatom assemblage returned to preconstruction conditions in the early 1940's. The subsequent construction in 1953 caused another decline in tychoplankton and replacement by Asterionella formosa and Cyclotella comta. Jake Lake, possessing a well-developed littoral zone, showed similar changes following road construction, except that Pinnularia biceps was probably favored by the increased nutrient levels in Jake Lake. Sediments from Delano Lake showed no such fluctuations in diatom or phytoplankton assemblages. (Cassar-FRC)
W83-00042

IMPACT OF CHROMIUM TO THE POPULATION DYNAMICS OF TISBE HOLOTHURIAE,
Athens Univ. (Greece). Zoological Lab. and Museum.
G. Verriopoulos, and M. Moraitou-Apostolopoulou.
Archiv fur Hydrobiologie, Vol 93, No 1, p 59-67, November, 1981. 2 Fig, 2 Tab, 19 Ref.

Descriptors: *Chromium, *Toxicity, *Population dynamics, Water pollution effects, Heavy metals, Metals, Sublethal effects, *Copepods, *Tisbe holothuriae, Embryonic growth stage, Eggs, Growth stages, Invertebrates.

The harpacticoid copepod Tisbe holothuriae was exposed to chromium levels of zero (control), 0.5, 1, and 2 mg per liter in water to determine the longevity of the parent (F2), longevity of the offspring (F3), number of egg sacs produced by the F2 generation, the interval between the formation of 2 successive sacs, the percentage of egg sac abortions, and numbers of F3 offspring. Survival of the F2 Tisbe was significantly affected at 1 and 2 mg per liter Cr, reduced to 9.9 + or - 0.63 days at 2 mg per liter concentration vs. 22.5 + or - 7.64 days for the controls. The F3 generation was more sensitive to Cr, surviving only 2 days at 2 mg per liter Cr. Number of egg sacs decreased with in-

creasing Cr concentration from 5.86 + or - 2.09 per female in the control to 1.41 + or - 0.63 at the 2 mg per liter concentration. No statistically significant difference was seen in the time needed for formation of a new egg sac in Tisbe exposed to all Cr concentrations. Abortion of egg sacs reached 88.8 + or - 29.9% at the 1 mg per liter Cr level and 96.88 + or - 27.18% at the 2 mg per liter level, compared with 36.9 + or - 28.2% in the controls. The number of F3 offspring per animal was 110.2 + or - 17.2 in controls and 6.6 + or - 1.2 at the 2 mg per liter Cr level. Tisbe grown in uncontaminated water took 12 days to develop from egg to adult, but those exposed to 0.5 mg per liter Cr took 20 days. Although exposure levels of Cr in this study were much less than the LC50 (17.36 mg per liter, 48 hours), significant damage was done to the Tisbe population by destroying animals in the embryonic stages, by inhibiting sexual maturation, and by prolonging the development period. (Cassar-FRC)
W83-00043

THE SEDIMENTS OF THE NEW ARTIFICIAL LAKE BOSTALSEE (SAARLAND, GERMANY), WITH PARTICULAR REFERENCE TO MICROBIAL ACTIVITY,
Universitaet des Saarlandes, Saarbruecken (Germany, F.R.). Dept. of Microbiology.
U. Zaiss.
Archiv fur Hydrobiologie, Vol 92, No 3, p 346-358, October, 1981. 7 Fig, 1 Tab, 18 Ref.

Descriptors: Sediments, *Eutrophic lakes, *Bacteria, *Eutrophication, *Lake sediments, Methane, Reservoirs, Lake Bostalsee, Anaerobic conditions, Sulfides, Sulfates, Sulfur bacteria, Nutrients, Micro-organisms, Heterotrophic bacteria, Iron, Phosphates, Nitrogen compounds, Water pollution effects, Benthic flora, Interstitial water, Organic matter, Wastewater pollution, Nutrients, Oxidation-reduction potential, Dehydrogenase, Enzymes, Seasonal variation, *West Germany.

The sediments of Lake Bostalsee, north Germany, were investigated during 1979-80 to evaluate the future of the lake. This 1.19 sq km artificial lake was impounded in 1977 without removing the rich agricultural soil. In 1977 untreated raw sewage escaped through a broken main under the lake for several months, producing a massive algal bloom during 1978. Two locations were examined, Site I in the shallow southwest and Site II, at maximum depth, 17 m. Redox potentials of the sediment were high in spring at both stations (+100 to +200 mV), decreasing to about -200 mV in August. The iron-rich interstitial water in the profundal sediments reached a maximum concentration of about 2 nmol Fe per liter during summer stratification. Phosphates, ammonium, and Kjeldahl nitrogen were higher in deep water sediments in summer and fall, nitrates and nitrites were higher in spring. Counts of aerobic, heterotrophic bacteria averaged 4.3 million per g wet sediment, increasing to 160 million per g sediment in August. Hydrogenase and dehydrogenase activities followed the same trends. Methane (average composition 40.8% methane and 57.7% nitrogen gas) was generated in summer and autumn when the redox potential was below -100 mV, mostly in the profundal zone. Sulfate concentrations were 0.18-0.13 nmol per liter in spring, decreasing to 0.07-0.08 nmol per liter by October. Sulfides were maximum (4.1 nmol per kg) at the end of stratification in October. The unusually low redox potential in summer and resulting anaerobic conditions were a result of the high organic carbon content, a source of energy for the heterotrophic organisms. Sulfate-reducing bacteria were very active. (Cassar-FRC)
W83-00048

CHARACTERIZATION OF ACID PHOSPHATASES IN THE ACIDIFIED LAKE GARDSJON, SWEDEN,
Uppsala Univ. (Sweden). Inst. Limnology.
M. Jansson, H. Olsson, and O. Broberg.
Archiv fur Hydrobiologie, Vol 92, No 3, p 377-395, October, 1981. 4 Fig, 7 Tab, 23 Ref.

Descriptors: *Acidic water, Lakes, *Enzymes, Water pollution effects, Acid rain, Lake Gardsjon, *Sweden, *Phosphatases, Seston, Phosphates, Oligotrophic lakes, Bacteria, Algae, Nutrients, Phosphorus.

The effect of acidification on phosphorus metabolism was studied in Lake Gardsjon, Sweden. The bedrock in the catchment consists mainly of granites, and consequently the soil has weak buffering capacity. This, coupled with acid rainfall, accounts for the very low pH of lake waters. Phosphomonoesterase activity in the oligotrophic lake, pH 4.6, measured in spring and early summer 1980, was 10 times higher than in other Swedish lakes. Budget calculations showed that phosphatase production occurred mainly within the lake and was not derived from external sources. Activities (nmol phosphate per liter per min) were: epilimnion, 0.9-10.5; metalimnion, 2.7-18.0; hypolimnion, 0.6-12.0; inlet, 2.4 -25.9; outlet, 1.4-7.5; artificial dams, 0.4-2.4; and a tributary lake, 3.5-20.2. Four different phosphatases were found. All of these were associated with the seston and two were in dissolved form. All were strictly acid with optimum pH of 5. Most of the seston-bound phosphatase activity was in particles less than 5 microns. The main contributors to phosphatase activity were small algae and bacteria; possibly some larger algae secreted dissolved enzymes. Phosphate competitively inhibited the 3 dominant phosphatases. The phosphatases remained active for at least 5 days in sterile filtrates. The acid phosphatase system in this lake is apparently an adaptation to low pH in an environment with severly limited phosphorus supply (6.1 micrograms per liter total P). (Cassar-FRC)
W83-00050

STORAGE OF CARBON AND TRANSPORT OF OXYGEN IN RIVER MACROPHYTES: MASS-BALANCE, AND THE MEASUREMENT OF PRIMARY PRODUCTIVITY IN RIVERS,
Miljostyrelsen, Silkeborg (Denmark). Freshwater Lab.
For primary bibliographic entry see Field 5B.
W83-00051

SEASONAL ABUNDANCE OF CERATIUM HIRUNDINELLA, (O.F. MULLER) SCHRANK IN LAKES OF DIFFERENT TROPHY,
Alberta Environmental Center, Vegreville.
J. W. Moore.
Archiv fur Hydrobiologie, Vol 92, No 4, p 535-548, November, 1981. 5 Fig, 4 Tab, 24 Ref.

Descriptors: Lakes, *Nutrients, *Phytoplankton, Water pollution effects, *Ceratium hirundinella, *Eutrophic lakes, *Oligotrophic lakes, *Eutrophication, Dinoflagellates, Algae, Subarctic zone, *Canada, Trophic level, Seasonal variation, Vertical distribution, Algal growth, Nutrients, Light intensity, Climatic zones, Mesotrophic lakes, Light penetration, Wastewater pollution.

The density of the dinoflagellate Ceratium hirundinella was determined from May 1978 to May 1979 in 6 subarctic lakes located north of Great Slave Lake. The lakes ranged from 0.6 to 45 sq km in area and from 11 to 98 m in depth. They were classified into 4 trophic groups: oligotrophic, 2 degrees of mesotrophic, and eutrophic. The study lakes were situated in a forested region of the Precambrian shield. Kam Lake, highly eutrophic, received a continuous discharge of primary treated sewage throughout the study. Three other lakes (Long, Grace, Madeline) also received a small amount of domestic waste from cottages. Lakes Prosperous and Prelude were strongly oligotrophic. The seasonal patterns and vertical distribution of phytoplankton density varied widely among the lakes but were similar to those reported for temperate zone populations. The growing season was 4-8 months long. Both unimodal and bimodal growth curves were seen. Although the short summers limited the growing season to June-October, the timing of peak abundance (July, August, or September) was not influenced. Seasonal changes in C. hirundinella abundance were independent of the dynamics of other algal species. Optimum temperature for growth was 4 to 18C. Late summer blooms were independent of temperature and were controlled by decreasing daylight length after June. Nutrient availability controlled the intensity, but not the timing, of abundance peaks. In the highly transparent lakes C. hirundinella grew in significant numbers at depths of 60-70 m because of high light penetration and oxygen levels. (Cassar-FRC)
W83-00052

AN INTEGRATED STUDY ON LITTORAL AND PELAGIC PRIMARY PRODUCTION IN A SOUTHERN AFRICAN COASTAL LAKE,
Department of Scientific and Industrial Research, Taupo (New Zealand). Freshwater Section.
C. Howard-Williams, and B. R. Allanson.
Archiv fur Hydrobiologie, Vol 92, No 4, p 507-534, November, 1981. 11 Fig, 3 Tab, 47 Ref.

Descriptors: *Productivity, *Phytoplankton, *Aquatic plants, Lakes, Swartvlei Lake, *South Africa, *Meromictic lakes, Littoral zone, *Primary production, Macrophytes, Potamogeton, Cladophora, Chara, Periphyton, *Standing crops.

The primary production and standing crops of various components of the plant community in the pelagic and littoral zones of Swartvlei, a meromictic coastal lake at the southern tip of Africa, were investigated from 1975 to 1978. Annual mean production in mg C per sq m per day was 74.0 in the phytoplankton, 621 in the littoral algae, and 2493 in the macrophytes. On a whole lake basis these values (in g per sq m per a) were phytoplankton, 19; littoral algae, 29; and macrophytes 72. The littoral zone occupied 30% of the lake area and produced 86% of the autochthonous carbon; the phytoplankton, 14%. The net production and the percentage of total net production by the nonplankton plant communities were further divided as follows: Potamogeton, 72 g C per sq m per a, 52%; Chara, 19 g C per sq m per a, 14%; Phragmites/Scirpus, 17 g C per sq m per a, 12%; epiphytic algae, 5 g C per sq m per a, 4%, and adnate periphyton, 5 g C per sq m per 4%. The littoral zone is the center of almost all biological activity in the lake system in terms of the food web and energy flow and is the most sensitive to damage by human activity. (Cassar-FRC)
W83-00053

SOME ASPECTS OF THE COLONIZATION BY WATER MITES (ACARI, ACTINEDIDA) OF AN ARTIFICAL SUBSTRATE IN A DISTURBED ENVIRONMENT,
Louvain Univ. (Belgium). Lab. of General and Experimental Ecology.
A. Dewez, and G. Wauthy.
Archiv fur Hydrobiologie, Vol 92, No 4, p 496-506, November, 1981. 2 Fig, 3 Tab, 16 Ref.

Descriptors: *Wastewater pollution, *Invertebrates, *Self-purification, Water pollution effects, Mites, Acari, Actinedida, Rivers, Bryophytes, Species composition, Species diversity, Hygrobates fluvatilis, Bocq River, *Belgium.

The water mite population was studied in the Bocq River, Belgium. The two main affluents of the Bocq, the Biron and the Leignon, are principally responsible for the pollution of the zone which has a gentle slope. The Leignon receives a large part of the sewage effluents of Ciney; the rest is drained by the Biron, which also carries the wastes from a slaughter house, dairy and cattle market. Since the natural bryophyte substrate had disappeared, pieces of sponge were installed in 6 stations in 3 zones as artificial substrate: oligosaprobic (A and B) upstream of outfalls; alpha-mesosaprobic (C and D) downstream of outfalls, and beta-mesosaprobic, (E and F). In March 1978 the total numbers of individuals were: A, 175; B, 100; and C to F, < 25 each. Total species numbers were: A,9; B,5; C,2; D,2; E,6; and F,3. There were also changes in the species distribution among the 3 zones. Self-purification was evident at station F, where some of the species present in the oligosaprobic zone were again observed. Apparently some of the water mites, especially several km in badly polluted water. (Cassar-FRC)
W83-00054

THE DEVELOPMENT OF ATTENUANCE DEPTH-PROFILING TO FOLLOW THE

CHANGING DISTRIBUTION OF PHYTOPLANKTON AND OTHER PARTICULATE MATERIAL IN A PRODUCTIVE ENGLISH LAKE,
Freshwater Biological Association, Ambleside (England).
J. F. Talling.
Archiv fur Hydrobiologie, Vol 93, No 1, p 1-20, November, 1981. 10 Fig, 32 Ref.

Descriptors: *Light penetration, Water depth, *Phytoplankton, Attenuance, Lakes, Seasonal variation, Measuring instruments, Esthwaite Water, *England, Iron compounds, *Particulate matter, Stratification, Temperature, Water temperature, Dissolved oxygen, Oxygen, Ceratium, Dinoflagellates, Thermoclines, *Vertical distribution, Thermal stratification.

A submersible beam transmissometer was adapted to record light attenuance directly against water depth. The apparatus was tested during summer stratification and autumn turnover (1975-77) in Esthwaite Water, England, where attenuance was related to the vertical distribution of particulate matter (phytoplankton and iron compounds). The device was simple and rapid in operation and produced good agreement in replicate profiles. Attenuance-depth profiles were related to temperature, dissolved oxygen, and the complex behavior of Ceratium hirundinella. This dinoflagellate avoids the surface in birght weather and accumulates above the oxycline. The apparatus was also used to produce a profile of horizontal variability over the lake, using 10 sampling stations. It revealed a dense population of Ceratium in the 0-6 m epilimnetic layer and an abundance of particulate ferric material at 7-12 m. (Cassar-FRC)
W83-00055

GUIDELINES FOR SURFACE WATER QUALITY: VOL 1: INORGANIC CHEMICAL SUBSTANCES: COPPER,
Department of the Environment, Ottawa (Ontario). Inland Waters Directorite.
For primary bibliographic entry see Field 5G.
W83-00079

THE TOXICOLOGY OF SILVER IODIDE IN RELATION TO ITS USE AS A CLOUD SEEDING AGENT,
Department of Water Affairs, Pretoria (South Africa); Hydrological Research Inst., Pretoria (South Africa).
For primary bibliographic entry see Field 2B.
W83-00084

IN SITU RESPONSE OF PHYTOPLANKTON FLUORESCENCE TO RAPID VARIATIONS IN LIGHT,
Institute of Ocean Sciences, Sidney (Australia).
M. R. Abbott, P. J. Richerson, and T. M. Powell.
Limnology and Oceanography, Vol 27, No 2, p 218-225, 1982. 5 Fig, 1 Tab, 30 Ref.

Descriptors: *Phytoplankton, *Fluorescence, *Light intensity, Lakes, *Lake Tahoe, *California, *Chlorophyll a, Inhibition, Limiting factors, Irradiation, Light penetration.

Fluorescence of phytoplankton chlorophyll a was measured in ultra-oligotrophic Lake Tahoe, California, at depths of 10, 35, and 60 m on June 13, 1980. Fluorescence yield was negatively correlated with surface irradiance at all depths. At 35 m the intensity of fluorescence change with light fluctuations was much stronger and the response of the phytoplankton to more rapid fluctuations in light was more apparent than at 10 and 60 m. Light conditions were near optimum at 35 m, light-inhibited at 10 m, and light-limited at 60 m. (Cassar-FRC)
W83-00141

WATER QUALITY IN URBAN STREAMS--WHAT WE CAN EXPECT,
North Carolina Dept. of Natural Resources and Community Development, Raleigh. Div. of Environmental Management.
A. M. Duda, D. R. Lenat, and D. L. Penrose.
Journal of the Water Pollution Control Federation, Vol 54, No 7, p 1139-1147, July, 1982. 5 Fig, 4 Tab, 30 Ref.

Descriptors: *Urban watersheds, *Water quality standards, *Monitoring, Water pollution effects, Water pollution sources, Wastewater pollution, Industrial wastewater, Asheville, *North Carolina, Benthic fauna, Aquatic life, Macroinvertebrates, Invertebrates, Fish, Urban runoff, Streams, Sediments, Worms, Tubifex, Limnodrilus, Runoff.

Water quality in 2 urban streams, Nasty Branch and Sweeten Creek, in Asheville, North Carolina, was assessed by aquatic biological monitoring and analysis of water chemistry and sediments. An upstream forested watershed station served as a control. The water quality in the urban stream was very poor. Mean numbers of macroinvertebrates per sq m were 197 in the control, 564 in Sweeten and 73 and 204 at 2 Nasty Branch sites. Mean number of species per sq m were 35.3 in the control and 10.3, 8, and 4, at the 3 urban sites, respectively. The urban stations were dominated by worms (Tubifex tubifex and Limnodrilus) and midges (Chironomus and Cricoptus). The fish food organisms (mayflies, stoneflies, and caddisflies) had been virtually eliminated. No fish were present in the urban reaches. The composition of the macroinvertebrate population suggests that organic wastes and toxic substances were resonsible for the poor quality of the water. Urban reaches contained much higher concentrations of BOD, COD, oil and grease, fecal coliforms, Al, Fe, and Mn, and somewhat higher levels of Cu, Pb, and Zn. In sediment samples Al, Cr, Cu, Fe, Mn, and Pb levels were elevated. In spite of the poor water quality only fecal coliform counts exceeded North Carolina water quality standards. Sources of pollution were the city motor pool and garage building, widespread and severe leaks in old sanitary sewer lines, and illicit industrial discharges. (Cassar-FRC)
W83-00144

BIOASSAY TECHNIQUE FOR RELATIVE TOXICITY IN WATER POLLUTION CONTROL,
Texas Univ. at Dallas.
For primary bibliographic entry see Field 5A.
W83-00146

DYNAMICS OF PHYTOPLANKTON IN FINNISH LAKES,
Maj and Tor Nessling Foundation, Helsinki (Finland).
V. Ilmavirta.
Hydrobiologia, Vol 86, No 1/2, p 11-20, January, 1982. 8 Fig, 1 Tab, 40 Ref.

Descriptors: *Phytoplankton, *Population dynamics, *Succession, Productivity, Humic acids, Lakes, *Finland, Seasonal variation, Biomass, Nutrients, Limiting factors, Color, Light inhibition, Water temperature, Species composition, Phosphorus, Euophtic zone, Oligotrophic lakes, Shallow water, Brown water.

Overall dynamics of phytoplankton in Finnish lakes, particularly brown water lakes, are reviewed. Early studies concerned either (1) species composition and taxonomy or (2) production dynamics. More recent work has combined both approaches with profound results. Most Finnish lakes are ultraoliogotrophic to slightly meso-oligotrophic. Poor production reflects the nutrient-poor soil and ancient acid bedrock. In humic lakes the euphotic layer is shallow, 3-4 m for water with colors of 50 mg Pt per liter or above. Summer productivity is not depressed during summer stratification, and therefore summer nutrient depletion is not apparent. Nutrients are rapidly recycled in the epilimnion. Vertical migration, enabling efficient maximum production without inhibition by prolonged high light intensities, is a major factor in phytoplankton dynamics in many humic lakes. Although phosphorus is limiting to productivity, water temperature and solar radiation are more important factors. Phytoplankton adapt to the short growing season by continuous changes in species composition and pigment concentrations of algae. Seasonal successions of species are rapid and distinct. For 3 lakes of different types (nutrient poor, mesohumic; eutrophic, mesohumic; and oligotrophic, very brown-water) seasonal succession and populations were very different. (Cassar-FRC)
W83-00153

HEAVY METALS IN OYSTERS AND CLAMS OF ST. LOUIS BAY, MISSISSIPPI,
Gulf Coast Research Lab., Ocean Springs, MS. Dept. of Analytical Chemistry.
T. F. Lytle, and J. S. Lytle.
Bulletin of Environmental Contamination and Toxicology, Vol 29, No 1, p 50-57, 1982. 4 Tab, 17 Ref.

Descriptors: *Bioaccumulation, Metals, *Clams, *Oysters, *Sediments, Sampling, Accumulation, Mollusks, Water pollution effects, Arsenic, Antimony, Beryllium, Cadmium, Chromium, Cobalt, Copper, Iron, Lead, Mercury, Molybdenum, Nickel, Selenium, Strontium, Titanium, Vanadium, Zinc, *St. Louis Bay, *Mississippi, *Heavy metals.

A study to establish typical values for 17 metals in the water, sediment, and biota of St. Louis Bay before the operation of an ore refinery (Ti02) is described. Metals analyzed were: As, Sb, Be, Cd, Cr, Co, Cu, Fe, Pb, Hg, Mo, Ni, Se, Sr, Ti, V, and Zn. Oysters and clams were collected at two sites, water was collected at eight sites, and sediment was collected at the oyster-clam sites and 12 other sites. Only As, Cd, Cu, Se, Zn, Fe, and Hg occurred at detectable levels in oysters and clams. Metal behavior of clams and oysters was consistent with that observed in other bays throughout the Southeastern US. The oyster accumulated As to levels twice that accumulated by clams, while clams accumulated Se twice as efficiently as oysters. As and Se occurred at levels less than those found at similar locations, casting doubt on test results using dry tissue. (Small-FRC)
W83-00159

WATER QUALITY STANDARDS AND WATER QUALITY,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5G.
W83-00162

USE OF MATHEMATICAL MODELS TO PREDICT IMPACTS OF MINING ENERGY MINERALS ON THE HYDROLOGIC SYSTEM IN NORTHWESTERN COLORADO,
TRW, Lakewood, Colorado, Energy Engineering Division.
For primary bibliographic entry see Field 4C.
W83-00168

WATER CHARACTERISTICS,
Construction Engineering Research Lab. (Army), Champaign, IL.
For primary bibliographic entry see Field 5B.
W83-00169

THE AEROBIC MINERALIZATION OF AMINO ACIDS IN THE SALINE LAKE GREVELINGEN AND THE FRESHWATER HARINGVLIET BASIN (THE NETHERLANDS),
Delta Inst. for Hydrobiological Research, Yerseke (Netherlands).
A. B. J. Sepers.
Archiv Fur Hydrobiologie, Vol 92, No 1, p 114-129, August, 1981. 3 Fig, 7 Tab, 26 Ref.

Descriptors: *Bacteria, *Amino acids, *Mineralization, Heterotrophic bacteria, Proteins, Haringvliet Basin, Lake Grevelingen, *The Netherlands, Saline lakes, Eutrophic lakes, Oxygen uptake, Algae, Seasonal variation.

The bacterial uptake of various C14-labeled amino acids and of an algal protein hydrolysate, containing C14-labeled amino acids, was observed at 4 week intervals from September 1976 to September 1977 in samples from saline Lake Grevelingen and eutrophic fresh water Haringvliet basin in the Netherlands. Seasonal variation of the uptake pa-

rameters was comparable for all applied amino acids. The maximum uptake rate (Vmax) of algal protein hydrolysate by the heterotrophic bacteria in Lake Grevelingen varied from 0.43 to 23.38 ng C per liter per hour with peaks in March and summer. For Haringvliet Vmax was 4 to 70 ng C per liter per hour with a peak in summer. Vmax for aspartic acid uptake was slightly lower; for glycine and leucine, much lower. In Lake Grevelingen the respiration percentages were: protein hydrolysate, 31-54%; aspartic acid, 74-87%; in Haringvliet, protein hydrolysate, 58-72%; glycine, 50-74%; leucine, 13-35%; histidine, 52-73%; and aspartic acid, 69-88%. The calculated uptake capacity (or potential uptake) in g C per sq m per year for protein hydrolysate was 10.9 for Grevelingen and 18.7 for Haringvliet. The individual amino acids had lesser values. These were about 3% of the amount of mineralized carbon, as calculated from oxygen uptake experiments. Results suggest that measurement of the uptake of C14-labeled compounds represents a serious underestimation of the bacterial activity in situ. (Cassar-FRC)
W83-00178

EXCRETION AND DOC UTILIZATION BY OSCILLATORIA RUBESCENS D.C. AND ITS ACCOMPANYING MICRO-ORGANISMS,
Bundesgesundheitsamt, Neuherberg (Germany, F.R.). Inst. fuer Strahleni hygiene.
T. P. Chang.
Archiv fur Hydrobiologie, Vol 91, No 4, p 509-520, July, 1981. 7 Fig, 1 Tab, 26 Ref.

Descriptors: *Eutrophic lakes, *Dissolved organic matter, *Cyanophyta, *Excretion, Radioactive tracers, Organic carbon, Lakes, Alpine regions, Aquatic population, Microorganisms, Organic compounds, Carbon dioxide, Eutrophication.

Oscillatoria rubescens, which often causes water blooms in alpine lakes, can be made to produce extracellular organic substances, including a large proportion of mucilage through stimulation by some of its accompanying microorganisms. The co-relationship of various cyanophytes was examined using O. rubescens and two newly isolated Synechococcus species. Excretion and dissolved organic carbon (DOC) utilization were measured in time course using a radioactive carbon method. A 4-6% range of extracellular release was measured for these red-colored cyanophytes under three different patterns of excretion. Carbon dioxide was the main exudate component for these three species. Most DOC produced was of a low molecular weight, especially for O. rubescens. Synechococcus was able to utilize its own exudates along with some exudates from other sources. This feature allowed the Synechococcus species to outgrow O. rubescens both in culture and in nature, and offers a possible explanation for the recession of O. rubescens in alpine lakes. (Geiger-FRC)
W83-00183

AN OVERVIEW OF ACID RAIN MONITORING ACTIVITIES IN NORTH AMERICA,
Flow General, Inc., McLean, VA.
J. Wisniewski, and J. D. Kinsman.
Bulletin of the American Meteorological Society, Vol 63, No 6, p 598-618, June, 1982. 3 Tab, 32 Ref.

Descriptors: *Monitoring, *Water pollution effects, *Acid rain, *Reviews, Ecological effects, Precipitation, Rainfall, Air pollution, Literature review, Environmental effects, Snow, Surveys, Fallout, *North America.

Acid rain is known to acidify natural waters, resulting in damage to fish and other components of the aquatic ecosystem, degradation of drinking water supplies, deterioration of man-made structures, erosion of soils and damage to forests and crops. Acidic components may be deposited from the atmosphere by wet deposition (rain and snow), dry deposition (particles and gases), and special events (dews, frosts, and fogs). Most current monitoring activities focus on wet deposition or acid rain. Recent monitoring devices and 71 studies conducted or on-going in North America are surveyed. Tables are presented that describe the name or title of the study, the organization or agency that funds each study, the chemical parameters monitored, the geographic extent and location of the study, the time period of operation, the types of samples used, where samples are analyzed, and a contact for further information. The Aerochem Metrics wet-dry collector is the most widely used instrument for collection of wet deposition and appears to be reliable in collecting precipitation samples for chemical analysis. Much of the wet deposition monitoring focuses on the between-year differences in precipitation acidity. No simple method for monitoring dry deposition is available on an experimental or commercial basis. The frequency of special events needs to be analyzed using existing climatological data. (Geiger-FRC)
W83-00189

STRUCTURAL CHARACTERIZATION OF AQUATIC HUMIC MATERIAL,
North Carolina Univ. at Chapel Hill. Dept. of Environmental Sciences and Engineering.
W. Liao, R. F. Christman, J. D. Johnson, D. S. Millington, and J. R. Hass.
Environmental Science and Technology, Vol 16, No 7, p 403-410, July, 1982. 4 Fig, 5 Tab, 25 Ref.

Descriptors: *Humic acids, *Chemical composition, *Organic matter, Lakes, Fulvic acids, Lake Drummond, Virginia, Black Lake, North Carolina, Degradation, Organic compounds, Aromatic compounds, Aliphatic compounds.

Aquatic humic materials from Black Lake, North Carolina, and Lake Drummond, Virginia, were degraded with potassium permanganate oxidation and NaOH hydrolysis, then methylated. Gas chromatography/mass spectrometric analysis identified 76 compounds representing about 35% of the original total organic carbon prior to degradation. The fulvic acid and humic acid fractions of both samples produced degradation products qualitatively similar to each other, but some quantitative differences were observed. Results suggest that aquatic humic substances contain aromatic and aliphatic components. The aromatic rings contain 3-6 substituents (alkyl, carboxylic acids, ketones, or hydroxy groups). Polynuclear aromatic and fused-ring structures (furan and possibly pyridine) may also be present. The principal aliphatic segments are short saturated chains (2-4C) with some branched structures. The identified degradation products were classified as follows: 29 benzenecarboxylic acid methyl esters, 5 furancarboxylic acid methyl esters, 14 aliphatic monobasic acid methyl esters, 14 aliphatic dibasic acid methyl esters, 5 aliphatic tribasic acid methyl esters, and 8 carboxyphenyl glyoxylic acid methyl esters. The carbon dioxide which evolved was probably derived from carbohydrates, phenols, quinones, and other structures. (Cassar-FRC)
W83-00190

IMPROVEMENTS IN QUANTIFYING THE PHOSPHORUS CONCENTRATION IN LAKE WATER,
Alberta Univ., Edmonton. Dept. of Zoology.
E. E. Prepas.
Canadian Journal of Fisheries and Aquatic Sciences, Vol 39, No 6, p 822-829, June, 1982. 2 Fig, 4 Tab, 29 Ref.

Descriptors: *Particulate matter, *Phosphorus, *Sampling, Lakes, *Bob Lake, *Ontario, Oligotrophic lakes, Zooplankton, Variability, Water analysis, Pollutant identification, Stratification.

Phosphorus concentrations in oligotrophic Bob Lake, Ontario, were determined with smaller variance by dividing the total P pool into 2 fractions: dissolved and particulate matter smaller than 250 microns and particulate matter larger than 250 microns. Samples were collected at several stations and depths, the smaller fraction by water bottle, and the larger fraction by tow net. Digestion by potassium persulfate gave more repeatable results (average variance $<$ 0.05 mg P per cu m) than perchloric acid digestion at the low P concentration encountered, often less than 5 mg per cu m. During stratification a vertical P gradient in the smaller fraction was evident. P levels were lowest in the mixed large layer (4-6 mg per cu m), slightly less in the hypolimnion, with a maximum in the metalimnion (6-8 mg per cu m). There were small but significant differences in P levels of the smaller fraction at stations less than 1 km apart. Of the total P (smaller plus large fractions), 13-28% was contained in the larger fraction in the epilimnion. The percentage of total P decreased with depth, 4-12% in the metalimnion, $<$ 1-3% in the hypolimnion. Thus the larger particle fraction was concentrated in the epilimnion and the dissolved and smaller P-containing matter, in the metalimnion. Removing the larger fraction (containing a few zooplankton with highly variable amounts of P) reduced the average variance associated with the mean P from 1.0 to 0.024 mg per cu m. (Cassar-FRC)
W83-00208

HEAVY METAL INTERACTIONS AND DYNAMICS IN SIMULATED NAUGATUCK RIVER MICROCOSMS,
Connecticut Univ., Storrs. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5B.
W83-00214

REEVALUATION OF THE EFFECTS OF DEICING SALT RUNOFF ON A SMALL URBAN LAKE,
Michigan Univ., East Lansing. Dept. of Zoology.
J. H. Judd, and J. W. Steggall.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-108332, Price codes: A02 in paper copy, A01 in microfiche. Completion Report, March 1982. 18 p, 3 Fig, 4 Tab, 14 Ref, 1 Append. OWRT A-114-MICH(1).

Descriptors: *Water analysis, *Lake morphology, *Urban runoff, *Highway icing, *Saline water intrusion, *Snowmelt, Chlorides, Deicers, Salt runoff, Water pollution, Water pollution control, Water quality, Water quality control, Nitrates, Saline water, Urban watersheds, Saline-freshwater interfaces.

Water samples were taken at a point near the lake center at 1-meter intervals from the surface to the bottom and from two primary inlets biweekly from January to October, 1981. Analyses were made for temperature, oxygen, conductivity, pH, alkalinity, chloride, and total phosphates, nitrates and total dissolved solids. While the amount of road salt entering from the lake subdivision was greatly reduced due to lowered use, the lake still receives an appreciable amount of salt runoff each winter. The major inflow is now from the highways north of the lake. Since the movement of saline water is through a small wetland before entering the lake, a more diffuse runoff occurs, apparently facilitating mixing of the saline water throughout the water column, thereby not greatly increasing stability of stratification. Hence, the lake can mix completely in the spring. The lake remains highly eutrophic; total phosphates are high throughout the year, while nitrate levels are greatly reduced. During the summer, nitrates were virtually undetectable. It may be that nitrates have become the limiting factor in the lake. During most of the 1981 winter, chloride concentrations were 150 mg/liter or less, except for one day in February when concentrations at one outflow reached 1250 mg/liter. Two weeks following, chloride in the bottom meter of water had increased from 96 to 720 mg/liter and the conductivity from 440 to 1000 micro-mhos. (Zielinski-MAXIMA)
W83-00227

ANOXIC NUTRIENT REGENERATION AND THE EUTROPHICATION OF ESTUARINE WATERS,
Rhode Island Univ., Kingston. School of Oceanography.
S. W. Nixon, and P. F. Roques.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-108027, Price codes; A06 in paper copy, A01 in microfiche. Final Report, 1981. 110 p, 18 Fig, 4 Tab, 98 Ref, 8 Append. OWRT B-082-RI(1).

Descriptors: *Eutrophication, *Estuarine environment, *Oxidation process, *Nutrients, *Water anal-

ysis, *Pettaquamscutt River estuary, Estuaries, Oxygen balance, Oxygen depletion, Organic compounds, Bottom sampling, Sediment-water interfaces, Phosphorus, Nitrogen, Silicon, Carbon, *Rhode Island.

The rates and stoichiometry of nutrient regeneration from sedimenting organic matter were investigated in the Pettaquamseutt River estuary under anoxic and oxic conditions. This estuary exhibits high organic matter sedimentation and reduced water circulation. It was observed that oxygen consumption in the water and sediments exceeds renewal processes and anoxic conditions develop. The stoichiometry of nutrient concentrations in the anoxic bottom water (carbon/sulfur/nitrogen/phosphorus/silicon ratio of 108:59.4:14.3:1.0:3.43) indicates that the nitrogen and phosphorus regenerated is greater than expected from anoxic zone sediment trap material (carbon/nitrogen/phosphorus ration of 140: 14:1). Organic matter oxidation rates and nutrient regeneration stoichiometry were directed measured by using chambers placed over the sediment and monitoring concentration changes in the isolated bottom water. The rate determined for carbon oxidation based on sulfide release (14.8 millimoles carbon/sq m/day) was found to be equal to that in nearby oxygenated sediments, and about half the rate observed in Narragansett Bay sediments at the same temperature (11 degrees). The elemental nitrogen/phosphorus ratio released was similar to the observed ratio of these metabolic products accumulating in the anoxic bottom waters. These data permit testing of recent models for organic decomposition under anoxic conditions. (Zielinski-MAXIMA)
W83-00263

THE EFFECTS OF EXCESSIVE NITROGEN AND PHOSPHORUS IN SURFACE WATERS OF A PRAIRIE MARSH,
Iowa State Univ., Ames. Dept. of Botany.
For primary bibliographic entry see Field 5G.
W83-00266

A PRELIMINARY STUDY OF NATURAL AQUIFER DISCHARGE OF GUAM,
Guam Univ., Agana. Water and Energy Research Inst. of the Western Pacific.
For primary bibliographic entry see Field 5B.
W83-00271

THE OCCURRENCE OF A FUNGAL PARASITE ON A TETRASELMIS (PRASINOPHYCEAE) SPECIES,
Rand Afrikaans Univ., Joannesburg (South Africa). Dept. of Botany.
J. Pretorius, and A. H. Engelbrecht.
Water SA, Vol 6, No 4, p 181-185, October, 1980. 12 Fig, 10 Ref.

Descriptors: *Eutrophication, *Algal growth, *Aquatic fungi, *Parasitism, *Pathogenic fungi, Algae, Aquatic life, Aquatic plants, Marine algae, Parasites, Morphology, Infection, Electron microscopy, Water quality, Diseases, Pathology, Plant pathology, South Africa, Vaal River Barrage.

Algal blooms develop annually from August to early September in the lower parts of the freshwater Vaal River Barrage, usually lasting for 2-3 weeks; microscopic studies of the algae in the dying-off stage of the bloom had shown that most of them were parasitized by a chytridial type of parasite. The occurrence of this type of parasite on a Tetraselmis species, the algae almost exclusively responsible for the blooms, was examined. The main ultrastructural features in identifying the alfa (e.g., the scales and hairs on the four flagella; the situation of the four flagella) are described. The infection of the algal host cells by the parasites, their reactions, and the final ultra-structural collapse of the cells, are reported and illustrated. The structure of this fungal parasite of Tetraselmis corresponds with that of the Chytridium reported previously, especially to the structure of the encysted zoospore and the penetration and structure of the haustorium. The role of the parasite in controlling Tetraselmis bloom could not be assessed. However, considering that the parasitizing of the host cells invariably leads to destruction of the host protoplasm and cell death, it is accepted that the parasite does play a role in limiting the bloom of Tetraselmis. Cytological study was made through the use of electron microscopy. (Zielinski-MAXIMA)
W83-00288

PERSISTENCE IN MODEL ECOSYSTEMS,
Georgia Univ., Athens. Dept. of Mathematics.
For primary bibliographic entry see Field 5B.
W83-00294

POLYNUCLEAR AROMATIC HYDROCARBONS AND CELLULAR PROLIFERATIVE DISORDERS IN BIVALUE MOLLUSCS FROM OREGON ESTUARIES,
Environmental Research Lab., Gulf Breeze, FL.
M. C. Mix.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-189523, Price codes; A04 in paper copy, A01 in microfiche. Environmental Protection Agency Project Summary EPA-600/S4-82-026, May 1982. 5 p.

Descriptors: *Clams, *Oysters, *Mussels, *Polynuclear aromatic hydrocarbons, *Water pollution effects, *Carcinogens, Mollusks, Estuaries, Monitoring, Shellfish, Solubility, *Oregon.

Indigenous populations of economically-important bivalve molluscs were used as monitors for detecting and quantifying 15 environmental polynuclear aromatic hydrocarbons (PNAH), including 11 compounds classified as carcinogens, 11 EPA Priority Pollutants, and 11 Toxic Pollutants. Baseline levels of PNAH were determined during a two-year for mussels, clams and oysters from different sites in Yaquina, Coos, and Tillamook Bays, Oregon. Total concentrations of the 15 unsubstituted PNAH were 30 to 60 micro g/kg in shellfish from uncontaminated waters to greater than 1000 micro g/kg in those from sites classified as contaminated. A major effort was made to determine and evaluate relationships between PNAH and their concentrations in shellfish. Multiple regression and multiple correlation techniques were used to identify and evaluate interrelationships between PNAH. A significant potential exists for developing predictive models for PNAH in aqueous environments and their concentrations in bivalve molluscs. Statistical analyses also indicated that concentrations of individual PNAH were greater for the isomer which had the greatest solubility in water. Cellular proliferative disorders resembling neoplastic conditions in vertebrates were found in mussels with the greatest PNAH concentrations. (Moore-SRC)
W83-00295

BACTERIOPLANKTON AFFECTED BY PHOSPHORUS PRECIPITATION TREATMENT IN A POLYTROPHIC LAKE,
Bayerisches Landesamt fuer Wasserwirtschaft, Munchen (Germany, F.R.).
For primary bibliographic entry see Field 5G.
W83-00315

PALEOLIMNOLOGY OF LAKE ISLE, ALBERTA, CANADA (INCLUDING SEDIMENT CHEMISTRY, PIGMENTS AND DIATOM STRATIGRAPHY),
Alberta Univ., Edmonton. Dept. of Botany.
For primary bibliographic entry see Field 2H.
W83-00316

POLYCYCLIC AROMATIC HYDROCARBONS IN SEWAGE, MUSSELS AND TAP WATER,
Central Inst. for Industrial Research, Oslo (Norway).
For primary bibliographic entry see Field 5B.
W83-00330

ACIDIC PRECIPITATION AND ITS CONSEQUENCES FOR AQUATIC ECOSYSTEMS: A REVIEW,
Columbia National Fishery Research Lab., MD.
T. A. Haines.
Transactions of the American Fisheries Society, Vol 110, No 6, p 669-707, November, 1981. 4 Fig, 3 Tab, 330 Ref.

Descriptors: *Air pollution effects, *Acid rain, *Aquatic habitats, *Hydrogen ion concentration, *Aerosols, Nitric acid, Sulfuric acid, Organic compounds, Metals, Water pollution, Fish, Algae, Macrophytes, Invertebrates, Environmental effects, Pollution effects, *Literature review.

Current understanding of the acid rain phenomenon, adverse effects of acid rain on aquatic ecosystems, and solutions to the problem are discussed. Increases in sulfuric and nitric acid aerosols have produced highly acidic precipitation which has affected surface waters. Contaminated waters have decreased alkalinity and pH and increased metals and organic compounds. Fish, decomposers, algae, macrophytes, and invertebrates have been affected primarily by hydrogen ion concentration changes but also by acid stress. Reduction of sulfur and nitrogen oxides, reduction of water acidity, and the breeding of resistant species are possible solutions. (Small-FRC)
W83-00331

THE FATE OF 2,4,6-TRICHLOROPHENOL IN AN AQUATIC CONTINUOUS-FLOW SYSTEM,
Jyvaskyla Univ. (Finland). Dept. of Cell Biology.
For primary bibliographic entry see Field 5B.
W83-00332

THE RELATIONSHIP BETWEEN NUTRIENT STATUS AND CHEMICAL COMPOSITION OF PERIDINIUM CINCTUM DURING THE BLOOM IN LAKE KINNERET,
Israel Oceanographic and Limnological Research Ltd., Tiberias; and Kinneret Limnology Lab., Tiberias (Israel).
D. Wynne, N. J. Patni, S. Aaronson, and T. Berman.
Journal of Plankton Research, Vol 4, No 1, p 125-136, 1982. 4 Fig, 3 Tab, 45 Ref.

Descriptors: *Peridinium, *Lakes, *Nutrient requirements, *Eutrophication, Dinoflagellates, Nutrients, Limiting nutrients, Carbon, Nitrogen, Chlorophyll, Phosphorus, Proteins, Carbohydrates, Lipids, Water temperature, Hydrogen ion concentration, Irradiation, *Lake Kinneret, *Israel.

The major cellular chemical components of Peridinium cinctum were analyzed to determine possible relationships between growth cycle parameters and nutrient sufficiency or deficiency. Decline of the Lake Kinneret bloom was not associated with physical or chemical parameters of the water. Average cell content was 48 for carbon, 4 for nitrogen, and .09% for chlorophyll (dry weight) for the growth season. Cell phosphorus dropped initially but then remained stable. During the bloom, protein showed no definite trend, but carbohydrate and lipid content decreased and nucleic acid increased. Thus, nutrient status did not limit Peridinium growth. Rapid decline of Peridinium in June is probably brought about by physical and chemical factors such as pH, temperature, and irradiation. (Small-FRC)
W83-00333

THE ECOLOGICAL EFFECTS OF 2-METHYLTHIOTRIAZINE HERBICIDES USED FOR AQUATIC WEED CONTROL IN NAVIGABLE CANALS, II. EFFECTS ON MACROINVERTEBRATE FAUNA, AND GENERAL DISCUSSION,
Liverpool Univ. (England) Dept. of Botany.
R. G. Hanbury, K. J. Murphy, and J. W. Eaton.
Archiv fur Hydrobiologie, Vol 91, No 4, p 408-426, July, 1981. 4 Fig, 1 Tab, 33 Ref.

Descriptors: *Water pollution effects, *Macroinvertebrates, *Submerged plants, *Aquatic weed control, *Herbicides, *Terbutryne, Marcrophytes, Aquatic populations, Aquatic plants, Pesticides, Species diversity, Navigation canals, Canals, Cyanatryn.

Macroinvertebrate fauna associated with aquatic macrophytes were studied in canals which had

been treated for weed control with suboptimal levels of terbutryne two years previously. Differences from untreated control canals were in most cases attributed to local variations in flora caused by factors other than herbicide treatment. Nevertheless, a site treated with terbutryne and cyanatryn in successive years was species deficient, both one and two years after herbicide applications. Loss of invertebrate taxa associated with the submerged macrophytes was an invariable feature, except where herbicide residue levels were ineffectively low. This effect was especially noticeable where residues were high and macrophyte destruction was most pronounced. Loss of invertebrate groups associated with the plants was compensated for by an increase in the abundance of benthic fauna, especially Nematoda and Lumbriculidae. However, at another site, filamentous algae which survived a less stringent herbicide treatment appeared to act as a refuge for the remaining macrophyte fauna, which recovered in parallel with the submerged flora by the following spring. (Geiger-FRC)
W83-00343

5D. Waste Treatment Processes

TRADE EFFLUENT CONTROL AND THE MICROPROCESSOR,
Anglian Water Authority (England). Lincoln Sewage Div.
For primary bibliographic entry see Field 5G.
W83-00003

INVESTIGATIONS ON CELLULOSE BIODEGRADATION IN ACTIVATED SLUDGE PLANTS,
Louvain Univ. (Belgium). Lab. of Industrial Microbiology and Biochemistry.
H. Verachtert, K. Ramasamy, M. Meyers, and J. Bevers.
Journal of Applied Bacteriology, Vol 52, No 2, p 185-190, 1982. 1 Fig, 4 Tab, 21 Ref.

Descriptors: *Biodegradation, *Wastewater treatments, *Anaerobic digestion, *Cellulose, Activated sludge, Municipal wastewater, Degradation, Microbial degradation, Bacteria, Actinomyces, Fungi, Microorganisms, Aerobic digestion, Sludge digestion, Organic compounds, Suspended solids.

The biodegradation of cellulose in activated sludge was studied. Cellulose is the major carbon substrate entering municipal wastewater treatment plants. Celluloytic microoranisms were isolated and enumerated in different treatment plants. In a study over a period of about 1 year, cellulolytic microbes were evaluated after different water treatment steps. The degradation of cellulose in nylon bags suspended in the activated sludge tank was examined, and the activities of cellulase components were assayed. The amounts of cellulose and lignin in the suspended solids arising from different treatment steps were also determined. Results indicated that active breakdown of cellulose occurred in the activated sludge. The biodegradation was mostly bacterial. Although no significant bacteria enrichment was found in the sludge floc, cellulase activity was increased. Nylon bag studies suggested that about 60% (wt/wt) of the cellulose entering the system could be degraded by bacteria during aerobic treatment, while 50-60% of the cellulose in the surplus activated sludge was broken down during anaerobic digestion. (Geiger-FRC)
W83-00013

CORRELATION OF ROTIFER ASSOCIATIONS IN A CHAIN OF LAKES FED BY RECLAIMED SEWAGE,
Concordia Univ., Montreal (Quebec).
For primary bibliographic entry see Field 5G.
W83-00023

TEXTILE INDUSTRY WASTEWATER TREATMENT BY AIR FLOTATION,
Department of the Environment, Ottawa (Ontario).
Report No. EPS-4-WP-79-6E, April, 1981. 61 p, 12 Fig, 17 Tab, 3 Append.

Descriptors: *Wastewater treatment, *Flotation, *Textile mill wastes, *Industrial wastewater, Water quality control, Coagulation, Flocculation, Textiles, Industrial wastes, Bleaching wastes, Industrial plants, Wastewater, Industrial water, Effluents, Water quality, Wastewater facilities, Wastewater disposal, Primary wastewater treatment, *Air flotation.

A pilot-scale study was initiated to demonstrate that textile industry wastewater could be reused after coagulation-flocculation and air flotation treatment. It was determined that this process offers great promise for recycle of some of the treated wastewaters, and could become an important energy conservation factor. Attempts to treat some specific process effluents, however, were unsuccessful. Tests were carried out at three different plants in Quebec province. The results were assessed by laboratory analyses and by limited recycling tests. Following 15 weeks of testing, it was concluded that air flotation is an excellent preliminary treatment, except in the case of very special effluents. Alum was the best coagulant for obtaining a clear colorless effluent. Most effluents treated contained a very significant amount of heat energy. For recycling, the three most promising textile effluents came from carpet dyeing. However, it was not possible to draw any conclusions for effluents from lot dyeing of polyester. Effluents from the Millitron, Kuster, and latex coating processes cannot be treated by air flotation. The results justify the recommendation that a full-scale air flotation unit for textile processing wastewater treatment be built. (Zielinski-MAXIMA)
W83-00080

STORMWATER RUNOFF TREATMENT BY IMPOUNDMENT: BARRHAVEN PILOT STUDY,
Ottawa-Carleton Regional Municipality (Ontario). Works Dept.
R. J. Gieta.
Report SCAT-8, 1981. 72 p, 36 Fig, 12 Tab, 8 Ref, 2 Append.

Descriptors: *Storm water, *Storm wastewater, *Storm runoff, *Rainfall-runoff relationships, *Wastewater treatment, Runoff, Impoundments, Storm-overflow sewers, Runoff coefficient, Runoff volume, Rainfall, Suspended solids, Bacteria, Nutrient removal, Runoff rates, Mathematical studies, Water treatment.

A 2-year study was conducted on stormwater runoff treatment by impoundment in an open basin, with the treatment system operated as a batch process for one summer and as a continuously-overflowing pond for another. Impoundment reduced pollutant loadings by over 90% for suspended solids, 75-90% for bacteria (total and fecal coliforms, and fecal streptococcus), and 25-50% for organic nitrogen and total phosphorus compounds when the runoff could be stored for over 12 hours. At least 5 mm of rainfall were needed to produce measureable runoff. Runoff/rainfall ratios estimated the runoff volumes that would be generated by up to 25-year return frequency storms of 1- and 2-hour durations. From this, a storage volume of 40,000-47,000 cu m was indicated, on the basis of runoff containment from a 10-year storm. The most effective treatment system operating method was to keep the reservoir drawn down to a shallow pond. When runoff entered the pond, the drain valve was closed and the treatment system filled. If possible, runoff volume was contained until its quality was suitable for discharge. When effluent quality became satisfactory, the reservoir was drained to the original shallow pond and dry weather flow allowed to pass through. Allowing one day to fill and one day for storage, the reservoir should require two days to empty. (Zielinski-MAXIMA)
W83-00083

THE CHARACTERIZATION AND PROCESSING OF LIME SLUDGES FROM WATER RECLAMATION PLANTS,
National Inst. for Water Research, Pretoria (South Africa).
M. Ronen.
CSIR Research Report WAT 55, 1978. 234 p, 172 Fig, 48 Tab, 159 Ref, 3 Append.

Descriptors: *Lime, *Sludge, *Reclaimed water, *Sludge drying, *Particle size, Water treatment, Sludge disposal, Dewatering, Organic matter, Particulate matter, Sludge volume index, Wastewater facilities, Waste disposal, Sludge conditioning, Sludge solids, Sludge thickening.

Sludges derived from lime treatment in water reclamation plants were characterized for their composition and their particulate, settling, dewatering, rheological, and recalcination properties. Sludge treatability was found to be controlled by particle properties, which are, in turn, determined by the lime treatment conditions. The effect of these conditions on the sludge properties was examined. The sludges were produced by lime treatment of sewage or secondary effluent. The scope of work comprised full-scale, pilot plant scale, and laboratory studies. It was found that the lime sludges represent a heterogeneous particulate mixture having both discrete particles and flocculent voluminous particulate matter. Sludge particles tend to agglomerate and show a compressible behavior. Sludges with different characteristics are produced from different lime treatment conditions. The presence of high magnesium in the influent censors deterioration in lime sludge dewaterability, causing overall resistance to filtration. Colloidal organic matter from sewage in the primary sludge also causes poor dewaterability, while large discrete particles in sludges from reclaimed lime use makes sludge dewatering easier. When sludges are produced with iron use, they possess thixotropic properties which can be described by a model. Reclaimed lime can be beneficiated on a particle size basis, containing 77-80% calcium oxide. (Zielinski-MAXIMA)
W83-00086

SIMPLE CONTROL TESTS FOR OPERATORS OF SMALL WASTEWATER TREATMENT PLANTS,
National Inst. for Water Research, Pretoria (South Africa).
R. J. L. C. Drews.
CSIR Technical Guide K51, 1980. 23 p, 1 Fig, 5 Tab, 1 Append.

Descriptors: *Wastewater treatment, *Testing procedures, *Water quality control, Wastewater facilities, *Water analysis, Field tests, Water quality, Test facilities, Water treatment facilities, Chemical analysis, Activated sludge process, Biofiltration, Stabilization ponds, Water quality standards, Physical properties, Physiochemical properties, Sludge digestion.

Instructions are provided covering simple test methods for the characterization of influent and effluent quality for use by small wastewater treatment plant operators. The described tests require only a minimum of laboratory space, no background of analytical chemical skills, little manipulative skill, and can be learned quickly. Instructions are given on sampling procedures, on physical characterizations (temperature, pH, flow, turbidity measurements), on sludge characterizations (settleable solids, settled volume, suspended solids, sludge volume index), and for influent and effluent quality (suspended solids, relative stability, ammonia nitrogen (NO, nitrite-N, nitrate-N, phosphate, and free and total chlorine). The nitrogen, phosphorus, and chlorine tests are performed using test kits. Each test method is followed by an explanation of how to interpret the results obtained. Guidance is also provided for the reporting of results, illustrated by examples in tabular and graphic formats. A listing of recommended tests is given relative to sampling points where they may be best applied for activated sludge plants, biofilter plants, and stabilization ponds. (Zielinski-MAXIMA)
W83-00092

THE USE OF OXYGEN TO UPRATE THE TREATMENT CAPACITY OF A CONVEN-

TIONAL SURFACE-AERATION PLANT AT HOLDENHURST (BOURNEMOUTH) SEWAGE TREATMENT WORKS,
Wessex Water Authority, Bristol (England). Avon and Dorset Recovery Div.
M. Robinson, R. A. Varley, and A. R. Kimber.
Water Pollution Control, Vol 81, No 3, p 391-398, 1982. 7 Tab, 2 Ref.

Descriptors: *Oxygenation, *Aeration, *Activated sludge process, *Wastewater treatment, Vitox oxygen units, Nitrification.

Vitox oxygen units were installed at the Holdenhurst, England sewage treatment works because the plant's effluent did not meet BOD standards even at less than design flows. Oxygen injection is regulated for carbonaceous oxidation only. The effluent is pumped to four nitrifying biological filters before discharge into the River Stour. Operation of the units is controlled by dissolved oxygen monitoring, either with continuous pumping and periodic oxygen injection or with both pump and oxygen under dissolved oxygen monitoring control. The operations of both subunits are described in detail. (Cassar-FRC)
W83-00133

A SIMULATION STUDY ON THE OPERATION OF LABORATORY SCALE ANAEROBIC DIGESTERS,
Cape Town Univ. (South Africa). Dept. of Chemical Engineering.
G. S. Hansford.
Water SA, Vol 8, No 2, p 69-73, April, 1982. 9 Fig, 1 Tab, 4 Ref.

Descriptors: *Anaerobic digestion, *Sludge digestion, *Kinetics, *Wastewater treatment, Simulation analysis, Biological treatment, Digestion.

Simulation analysis and experimental runs of laboratory anaerobic digesters at constant sludge age and constant sludge concentration were used to determine kinetic parameters. At constant sludge age the system's response to changes in operating conditions was very slow, 3-5 times the sludge age, making experimental studies impractical. However, under constant sludge concentration conditions the response time was much shorter, on the order of the hydraulic residence time. Simulation analysis showed that a step change in feed rate from 20,000 to 30,000 mg COD per liter in a reactor operated at constant sludge concentration of 14,600 mg per liter and hydraulic residence time of 2 days attained a new steady state within 1.1 days. The reactor, operated at constant sludge age of 30 days, required 300 days to reach a new steady state. The 99% levels of recovery were 0.32 and 145 days for the constant concentration and constant age runs, respectively. For a 4 day hydraulic retention time the recovery of the steady state took 2.1 and 300 days, respectively. The microbial systems used in the simulation obeyed a simple Monod kinetic model. Conclusions drawn from this study may not apply to systems subjected to inhibition from toxic materials. (Cassar-FRC)
W83-00138

HIGH-QUALITY TRICKLING FILTER EFFLUENT WITHOUT TERTIARY TREATMENT,
Brown and Caldwell, Eugene, OR.
D. P. Norris, D. S. Parker, M. L. Daniels, and E. L. Owens.
Journal of the Water Pollution Control Federation, Vol 54, No 7, p 1087-1098, July, 1982. 8 Fig, 4 Tab, 5 Ref.

Descriptors: *Trickling filters, *Clarifiers, *Solids contact processes, Aeration, Flocculation, Biological wastewater treatment, Sedimentation, Sludge, *Advanced wastewater treatment, *Secondary wastewater treatment.

A secondary sedimentation process in a Corvallis, Oregon, trickling filter plant was modified to achieve both secondary treatment (monthly BOD5 and suspended solids average of < 30 mg per liter) and advanced wastewater treatment (monthly BOD5 and suspended solids average of < 10 mg per liter). The new process, named trickling filter/solids contact process, used solids contact clarifiers for enhanced suspended solids removals from trickling filter effluent. Sludge was recirculated to an aerated channel after the trickling filter and ahead of the clarifier to maintain the flocculating properties of the recycled solids. Here a significant amount of BOD was also removed. The secondary sedimentation tanks had center wells with gently stirring mechanical flocculators. No chemicals were added in the flocculation process. This system produced a monthly average of 10 mg per liter BOD and suspended solids at filter loading rates of 561 g per cu m per day. Optimum liquor solids concentration was 500-1500 mg per liter. The secondary sludge produced was exceptionally dense and fast-settling. Sludge yields were comparable to those found in the conventional activated sludge process. (Cassar-FRC)
W83-00142

BIOOXIDATION OF PAINT PROCESS WASTEWATER,
Ford Motor Co., Dearborn, MI. Chemistry Dept.
J. A. Brown, Jr., and M. Weintraub.
Journal of the Water Pollution Control Federation, Vol 54, No 7, p 1127-1130, July, 1982. 5 Fig, 1 Tab, 7 Ref.

Descriptors: *Biooxidation, *Industrial wastewater, *Solvents, *Paint industry, Biodegradation, Degradation, *Wastewater treatment, Activated sludge process, Cellosolve, *Oxidation.

A paint process wastewater effluent (COD 900-1000 mg per liter) and a simulated paint wastewater containing cellosolve (COD 500 mg per liter) were treated in a modified laboratory scale continuous-flow completely mixed aerated activated sludge reactor. Cellosolve (2-ethoxy ethanol) comprised about 47% of the identified organic material in the paint process wastewater. The coefficient of substrate removal at an average mixed liquor volatile suspended solids concentration of 3200 mg per liter was 0.00012 liters per mg per 20 hour workday for cellosolve and 0.00017 liter per mg per 20 hour workday for the paint process wastewater. Cellosolve biodegradation, 39% at 1.2 days' residence time, increased to 87% at 2.4 days' residence time. The paint wastewater biodegradation increased from 40% at 0.4 day's residence time to more than 80% at 1 day's residence time. Gas chromatographic analysis of the cellosolve effluent showed that 100% of the cellosolve was degraded in 2.4 days, but only 87% of the COD. This suggests that cellosolve degradation products were not biodegraded at the same rate or by the same metabolic pathway as seen in cellosolve degradation. (Cassar-FRC)
W83-00143

RECYCLING OF MERCURY AND SILVER FROM COD TESTS,
Wayne County Dept. of Public Works, Wyandotte, MI.
S. Aslam, and O. L. Walker.
Journal of the Water Pollution Control Federation, Vol 54, No 7, p 1148-1151, July, 1982. 5 Tab, 5 Ref.

Descriptors: *Chemical oxygen demand, *Silver, *Mercury, *Wastewater treatment, Pollutant identification, Metals, Heavy metals, Reclamation, *Recycling, *By-product recovery.

Mercury and silver were recovered from COD testing solution. NaCl was added to the waste solution to precipitate AgCl. The precipitate was washed with warm dilute sulfuric acid and distilled water to remove traces of impurities, dried, and stored for later recovery of metallic Ag. The filtrate, containing Hg, was treated with FeS to precipitate HgS. The AgCl was reduced to the metallic state, 99.9% pure, using powdered Zn and dilute sulfuric acid. The COD reagent, AgS04, was prepared by adding nitric acid and sulfuric acid to the metallic Ag. HgS was converted into the reageant mercuric dioxysulfate by HCl addition to form HgCl2. Addition of NaOH, followed by dilute sulfuric acid, formed the lemon yellow precipitate mercuric dioxysulfate, Hg(HgO)2S04. This new method removed 98.0% of Hg, whereas the EPA recommended method removed 96.4%. COD was determined in 20 samples containing 38-1272 mg per liter COD using reclaimed reagents and the standard procedure. There was no significant difference between results in the 2 groups. Recycling of Ag and Hg can reduce costs of the COD test by 60-70%. (Cassar-FRC)
W83-00145

MANAGEMENT AND CONTROL TECHNOLOGY FOR URBAN STORMWATER POLLUTION,
Santa Clara Univ., CA. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5G.
W83-00148

ADENOSINE TRIPHOSPHATE AS A CONTROL PARAMETER FOR ACTIVATED SLUDGE PROCESSES,
Philip M. Botch and Associates, Bellevue, WA.
P. C. Roe, Jr., and S. K. Bhagat.
Journal of the Water Pollution Control Federation, Vol 54, No 3, p 244-254, March, 1982. 12 Fig, 2 Tab, 29 Ref.

Descriptors: *Activated sludge process, *Adenosine triphosphate, *Process control, Performance evaluation, Biomass, Kinetics, Settleable solids, Suspended solids, *Wastewater treatment.

Effective activated sludge process treatment of municipal and industrial wastewaters depends on control of the kinetic and settling properties of the sludge, which in turn relies on maintenance of proper biomass levels. Previous studies have shown that adenosine triphoshate (ATP) is a good parameter for studying the viable biomass content of activated sludge, provided that shocks and environmental stresses are minimized. The use of ATP as a measure of the viable biomass concentration in analyzing the biokinetic and settling properties of activated sludge was investigated. Using ATP as a measure of living biomass and suspended solids as a measure of total biomass, the viability of the culture was found to be directly proportional to the ratio of ATP to suspended solids. The viability was shown to be a function of the net specific generation rate of the nonviable biomass, and the net growth rate of the viable biomass was shown to be directly related to the substrate removal rate of the living organisms. Evaluation of the kinetic coefficients showed that the death rate of viable organisms and the decay rate of nonviable biomass were high. The sludge settling characteristics were shown to be functions of the mean cell residence time and the ATP to suspended solids ratio. The sludge volume index was very high at a low mean cell residence time and high ATP to suspended solids ratio, but dropped rapidly and stabilized as the sludge aged and the viability decreased. It is concluded that ATP is a good indicator of the biokinetic and settling characteristics of activated sludge under laboratory steady-state conditions. However, further research is needed to determine the applicability of ATP under nonsteady-state conditions and to understand the mechanism of solid/liquid separation. (Carroll-FRC)
W83-00149

IMPROVEMENTS IN FOAM FLOTATION FOR LEAD REMOVAL,
IBM Corp., Houston, TX.
M. A. Slapik, E. L. Thackston, and D. J. Wilson.
Journal of the Water Pollution Control Federation, Vol 54, No 3, p 238-243, March, 1982. 3 Fig, 2 Tab, 8 Ref.

Descriptors: *Flotation, *Foam separation, *Wastewater treatment, *Lead, Heavy metals, Colloids, Cost analysis, Pilot plants, Industrial wastewater.

Current regulations mandate that the concentration of lead in industrial effluents be less than 0.10 milligrams per liter. These wastewaters can be treated by chemical precipitation, ion exchange, carbon adsorption, reverse osmosis, or electrodialysis. However, each of these methods has drawbacks. Adsorbing colloid foam flotation has been shown to be extremely effective in removing lead

from industrial wastewaters. A pilot plant was designed to evaluate and perfect the treatment of lead-containing wastewaters by foam flotation. Objectives of the project were to obtain consistent effluent lead concentrations less than 0.10 milligrams per liter; to increase the hydraulic loading rate while maintaining effluent quality; to develop a sodium lauryl sulfate recycle system; to evaluate the effect of raising the column dispersion head to reduce high air requirements and foam clotting at the top of the column; and to generate cost data on lead removal. Advantages of colloid foam flotation are the simplicity and effectiveness of the method, its moderate costs, the production of a concentrated and easily handled sludge, and the relatively small amount of space required for a complete adsorbing colloid foam flotation system. (Carroll-FRC)
W83-00150

ADVANCED TREATMENT.
Public Works, Manual, p D35-D42, 1982. 4 Fig.

Descriptors: *Advanced wastewater treatment, *Tertiary wastewater treatment, *Mechanical equipment, Ion exchange, Chemical treatment, Disinfection, Filters, Screens, Adsorption, Biological filters, Clarification, *Wastewater treatment, Land disposal, Spray irrigation.

Advanced or tertiary wastewater treatment is discussed. Solids can be removed using multi-media filters or micro-strainers, and nutrients and organics can be absorbed by carbon filters, ion exchange processes, and biological filters. Chemicals are used to reduce suspended solids, control phosphorus, and thicken sludge. Physical-chemical treatment plants are primary plants which meet the standards set for advanced treatment. Components of the system are: pretreatment, clarification, filtration, adsorption, and disinfection. Land application is a method which can result in zero discharge of treatment effluents into waterways. Overland flow and spray irrigation systems result in further renovation of treated wastewater. Equipment designed for the treatment methods discussed is listed, including suppliers. (Small-FRC)
W83-00151

SLUDGE DIGESTION AND DISPOSAL.
Public Works, Manual, p D42-D53, 1982.

Descriptors: *Sludge digestion, *Sludge disposal, Mechanical equipment, Digestion, Biodegradation, Sludge, *Wastewater treatment, Anaerobic digestion, Biological treatment, Aerobic digestion, Sludge drying, Incineration, Chemical treatment.

Treatment processes applied to sludge digestion and disposal are discussed. Equipment and processes used in anaerobic digestion includge tanks, fermentation process, sludge handling, gas collection, supernatant disposal, mixing and scum breaking floating covers, and sludge heaters. Aerobic digestion equipment is also described. Equipment for utilization of gas produced during the digestion process, chemicals for stabilizing raw sludge, and sludge dewatering devices are also considered. Sludge can be used as fertilizer with the help of equipment including tank trucks, sludge shredders, composters, and codisposal processes with solid wastes. Equipment is available for drying filter cake and for the incineration, wet-air oxidation, or fluidized-bed incineration of sludge. Sources are listed for most of the equipment described. (Small-FRC)
W83-00152

DISINFECTION, ODOR PREVENTION AND CONTROL.
Public Works, Manual, p D53-D57, 1982.

Descriptors: *Disinfection, *Odor control, *Chlorination, *Ozonation, Odors, *Wastewater treatment, Chlorine, Ozone, Advanced wastewater treatment, Bromine chloride, Sulfur dioxide, Hydrogen sulfide, Chemical treatment, Mechanical equipment.

Final treatment of effluent from secondary or advanced treatment processes often includes disinfection, odor prevention, and odor control. Disinfection is achieved through the use of chlorine, ozone, or ultraviolet radiation. Bromine chloride and sulfur dioxide are alternatives to chlorine treatment. Control of hydrogen sulfide is important at a disinfection facility. Odor prevention and control are implemented using deodorizing chemicals and odor combustion and adsorption. Equipment and chemicals available for disinfection and odor control are described and sources are given. (Small-FRC)
W83-00154

OPERATION CONTROL.
For primary bibliographic entry see Field 5G.
W83-00155

SEWER MAINTENANCE AND REHABILITATION.
Public Works, Manual, p D62-D67, 1982.

Descriptors: *Maintenance, *Sewer systems, *Leakage, *Cleaning, Pipes, Sewers, Mechanical equipment, Safety, Current meters, Conveyance structures.

Equipment for the inspection, cleaning, and repair of sewer systems is discussed. Equipment is available to evaluate sewer performance including inflow meters, infiltration/inflow analysis, and smoke testing. Equipment designed to remove obstructions in sanitary sewer lines includes hydraulic propelled devices, mechanical rodding equipment, machines for direct removal such as sand removal, hydraulic pressure rodding, and chemicals. Television inspection of cleaned lines is useful. Equipment and products are available for the rehabilitation of sewer lines or the sealing of leaks and breaks. Contractors are listed who provide sewer cleaning, major repair, or locating services. Safety equipment for maintenance crews is also described. Suppliers are listed for most of the types of equipment discussed. (Small-FRC)
W83-00156

CONTROL OPERATIONS AND MAINTENANCE SERVICES.
Public Works, Manual, p D67-D71, 1982.

Descriptors: *Wastewater facilities, *Administration, *Maintenance, *Process control, Optimization, Water treatment facilities, Operating policies, Professional personnel, Planning, Contracts, Computers, Automation.

Control of operations and maintenance services of wastewater treatment plants is discussed including a consideration of private sector firms offering full and partial services. The advantages and disadvantages that contract operations firms can offer are considered in the areas of process optimization, budget systems and financial control, at-site management teams, organizational structure and administrative skills, computerization, preventive maintenance, and certification training. Information is also presented on how to select a private contractor. In general, the firms can provide useful professional assistance to operators of wastewater and sewage treatment plants. Computerization is a special strength of many contractors and can increase plant efficiency and improve preventive maintenance programs. (Small-FRC)
W83-00157

WATER RECLAMATION AND REUSE,
Alberta Univ., Edmonton. Dept. of Civil Engineering.
S. E. Hrudey.
Journal of the Water Pollution Control Federation (Literature Review Issue), Vol 54, No 6, p 654-673, June, 1982. 402 Ref.

Descriptors: *Literature reviews, *Water reuse, *Reclaimed water, *Water renovation, *Reviews, Water conservation, Impaired water use, Wastewater irrigation, Wastewater reclamation, Industrial wastewater, Municipal wastewater, Irrigation water, Aquaculture, Groundwater recharge, Recharge, Infiltration, Public health, Fate of pollutants.

A review of recent literature on water reclamation and reuse was divided into several headings: general; agriculture and irrigation; groundwater recharge; industrial water reuse; municipal, commercial, and domestic reuse; health considerations of using reclaimed water; and technology development. Books, manuals, and reviews on water reuse and conservation were described. Several papers concerned reuse of reclaimed wastewaters or irrigation tail water for agricultural irrigation. Tannery wastewater proved useful in rehabilitation of sodic soil in Pakistan. Salt tolerant crops were irrigated with cooling water blowdown. Many investigators were concerned with reuse of municipal wastewater in irrigation. Performance of sugarcane, corn, cotton, and alfalfa crops irrigated with wastewater effluent was better than that obtained through irrigation with conventional irrigation water. Wine grapes were adversely affected by wastewater irrigation. Cooling water effluents and some municipal wastewaters were suitable for use in aquaculture systems; some domestic wastewaters and landfill leachates were not. Recycling treated wastewater into wetlands was an inexpensive and acceptable disposal alternative. Groundwater recharge with wastewater effluent was studied in several sites. Some contaminants were satisfactorily removed by the infiltration process; chlorinated hydrocarbons and viruses tended to break through. (Cassar-FRC)
W83-00163

PULP AND PAPER EFFLUENT MANAGEMENT,
Tufts Univ., Medford, MA.; and National Council for Air and Stream Improvement, Inc., Medford, MA.
G. W. Gove.
Journal of the Water Pollution Control Federation (Literature Review Issue), Vol 54, No 6, p 704-716, June, 1982. 130 Ref.

Descriptors: *Literature reviews, *Pulp and paper industry, *Wastewater treatment, *Industrial wastewater, *Reviews, Paper industry, Pulp wastes, Kraft mill wastes, Bleaching wastes, Water reuse, Water conservation, Oxygen demand, Water pollution effects, Aquatic life, Fish, Mutagens, Toxicity, Organic compounds, Wastewater analysis, Oxidation, Sulfite liquors, Fermentation, Membrane processes, Sludge, Incineration, Biological treatment, Anaerobic digestion, Phenols.

A review of current literature on management of pulp and paper effluents included receiving waters, biological effects, effluent characterization, pulping liquor disposal and recovery, physicochemical treatment, and biological treatment. Several general papers concerned environmental regulations, federal hazardous waste regulations, the progress in Canada's pulp and paper industry water pollutant abatement program, and economic aspects of environmental protection measures. Several literature reviews and papers covered developments in effluent sources and treatment. Studies on biological effects of pulp and paper mill effluents included fish development, bioaccumulation of resin acids in trout, bioassays on fish and invertebrates, and mutagenicity of effluents and sediments. Methods for characterizing effluents were developed or improved for the following categories: priority pollutants, effluent limitations, BOD and COD, toxic compounds, anthraquinone, chlorinated compounds, and components of process streams and effluents. Pulping liquor disposal and recovery was accomplished by several methods of chemical recovery (wet air oxidation, ultrafiltration and reverse osmosis, and oxygen delignification). Recovery of byproducts and reduction of waste loads was done by fractionation and fermentation. Physicochemical treatment methods included water reuse and spill control by total suspended solids monitoring, effluent recycling, vacuum pump seal water recovery, removal of solids by gravity straining, and slime control. (Cassar-FRC)
W83-00164

ADSORPTION OF TOXIC AND CARCINOGENIC COMPOUNDS FROM WATER,
Michigan Univ., Ann Arbor. Dept. of Environment and Water Resources Engineering.

For primary bibliographic entry see Field 5F.
W83-00171

REMOVING SOLUBLE ORGANIC CONTAMINANTS BY LIME-SOFTENING,
Illinois Univ. at Urbana-Champaign. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5F.
W83-00172

IMPROVEMENT IN COAL PREPARATION-WATER CLARIFICATION THROUGH POLYMER FLOCCULATION,
Dow Chemical Co., Tulsa, OK. Dowell Div.
W. C. Foshee, M. J. Swan, and R. R. Klimpel.
Mining Engineering, Vol 34, No 3, p 293-297, March, 1982. 8 Fig, 2 Tab, 5 Ref.

Descriptors: *Wastewater treatment, *Chemical coagulation, *Flocculation, Prediction, Coal, Wastewater renovation, Performance evaluation, Economic aspects, Cost analysis.

Coal preparation plants use large volumes of water, necessitating the use of water recycling technology. Economical cleansing of dirty water in these plants usually requires flocculation with an efficient organic polyelectrolyte. The usefulness of laboratory data for predicting relative flocculant and coagulant results in the wastewater treatment systems for these plants was investigated. A modified cylinder settling test and a laboratory model Enviro-Clear Clarifier were used to obtain laboratory solids concentration data. Full scale field trials were then used to confirm the laboratory results. The tests were designed to compare the performances of two coagulants with and without a flocculant pretreatment. The tests showed that the chemicals investigated used a combination of charge effect neutralization and polymer bridging in the treatment of the wastewater slurries. The presence of a strong flocculant bridging mechanism reduced the level of coagulant required and, to some extent, reduced the differences between types of coagulant chemicals. The use of a small amount of flocculation pretreatment was more efficient than a pure coagulation approach in treatment of the wastewaters studied. Although waste slurries not requiring charge neutralization can be treated with flocculant alone, a combined flocculant/coagulant system provided better plant economics for the wastes studied than either flocculants or coagulants alone. The cylinder testing provided a simple, quick, and effective screening tool for identifying the best polymers to be used for the water clarification system and for determining treatment sequence. Full-scale plant tests must be used to confirm the laboratory test results, to optimize treatment, and to make a final economic evaluation. (Carroll-FRC)
W83-00177

EFFECT OF ACTIVATED SLUDGE OPERATIONAL CONDITIONS ON SLUDGE THICKENING CHARACTERISTICS,
Chulalongkorn Univ., Bangkok (Thailand). Dept. of Sanitary Engineering.
M. Tuntoolavest, and C. P. L. Grady, Jr.
Journal of the Water Pollution Control Federation, Vol 54, No 7, p 1112-1117, July, 1982. 2 Fig, 5 Tab, 5 Ref.

Descriptors: *Activated sludge process, *Clarification, *Sludge thickening, *Wastewater treatment, Biological wastewater treatment, Sludge volume index, Sludge solids, Mixed liquor solids, Settling velocity.

Two 348 liter activated sludge pilot plants were operated in parallel at 1.9 liters per minute flow rate and solids retention time of 10 days to determine the effects of operational parameters on sludge thickening characteristics. Sludge volume index (74-139 ml per g) and zone settling velocity data revealed no clear effects of mixed liquor suspended solids concentration (1254-3117 mg per liter), air flow rate (4.53-6.80 cu m per hour), and sludge recycle ratio (30%-80%) on sludge thickening. Since clarification is significantly affected by the same conditions, it should be possible to adjust the operational conditions in a plant to produce optimum clarification characteristics without a great risk of adversely affecting its sludge thickening properties. (Cassar-FRC)
W83-00179

MANPOWER NEEDS IN WASTEWATER TREATMENT AND COLLECTION SYSTEMS FOR THE YEARS 1980 TO 2000,
Southern Illinois Univ. at Edwardsville. Environmental Resources Training Center.
For primary bibliographic entry see Field 5G.
W83-00180

STABILIZING HIGH-STRENGTH WASTES WITH PHOTOSYNTHETIC BACTERIA,
Orange Free State Univ., Bloemfontein (South Africa). Inst. for Environmental Science.
D. F. Toerien, T. E. Cloete, P. J. Du Toit, and P. J. Botes.
Water SA, Vol 8, No 2, p 92-96, April, 1982. 1 Fig, 4 Tab, 17 Ref.

Descriptors: *Photosynthetic bacteria, *Feedlot wastes, *Waste treatment, *Organic wastes, Wastewater treatment, Sludge, Bacteria, Fermentation, Algae, Animal wastes, Farm wastes, Manure, Feedlot runoff, Barn wastewater, Agricultural runoff.

The COD of concentrated organic wastes (sewage sludge and cattle feedlot effluent) was reduced by over 90% in a system combining 3 units: fermentation, photosynthetic bacterial degradation, and algae. This operation was done in the laboratory and in small outdoor units. For example, cattle feedlot effluent, COD 25,920 mg per liter and BOD 500 mg per liter, was subjected to fermentation for 2 days in the outdoor unit under autumn conditions (12-23C daily temperature range). Organic matter was degraded into a fatty acid mixture, COD 14,634 mg per liter and BOD 480 mg per liter. In the second unit photosynthetic bacteria decomposed the fatty acid mixture during an 8 day detention time to a mixture with 11,480 COD mg per liter and 450 BOD mg per liter. Further exposure in the algae unit for 8 days reduced COD to 1842 mg per liter and BOD to 190 mg per liter. Final chlorophyll a concentration was 1200 micrograms per liter. The outdoor unit also produced good results under winter conditions, 0-20C. The resulting product showed promise as a single cell protein source. (Cassar-FRC)
W83-00181

WATER MANAGEMENT IN THE OIL SHALE INDUSTRY,
CH2M/Hill, Bellevue, WA.
J. D. Mavis, Jr., and R. M. Rosain.
Chemical Engineering Progress, Vol 78, No 6, p 61-69, June, 1982. 5 Fig, 3 Tab, 22 Ref.

Descriptors: *Wastewater treatment, *Oil shale, *Mine wastes, *Water management, Wastewater renovation, Leachates, Mine drainage, Wastewater disposal, Waste disposal, Water reuse, Shales, Wastewater management, Land disposal, Heavy metals, Activated carbon.

At present 40 private companies and the United States Navy have over 2,850 sq km of oil shale holdings. Shale oil production generates solid, liquid and gaseous wastes. Both in-situ and surface retorting of shale have the potential for polluting water through retort water, off-gas condensates, and mine water. Surface retorting operations also produce spent shale leachate. Direct surface discharge and land application of wastewaters connected with shale oil production have been found to be unfavorable due to their high salt content, heavy metal concentrations and levels of boron, fluoride and other organics. The disposal of shale oil wastewater by treatment and discharge or wastewater reuse are more viable alternatives. Some advantages of wastewater reuse on the shale oil mining site are listed. To select a suitable wastewater treatment operation, the most cost-effective reuse options should be identified. Solid wastes originating from clarification and media filtration can be dewatered and disposed of with spent shale. Possible treatment technologies for off-gas condensate and potential uses for recovered water are considered. Organics have been most successfully removed from retort waters by mechanical evaporation followed by activated sludge bio-oxidation of the distillate, followed by activated carbon treatment. Synfuel wastewater treatment options are currently being studied by several private industries, government and energy and environmental agencies. (Geiger-FRC)
W83-00185

FIXED-FILM BIOLOGICAL PROCESSES,
J. Josephson.
Environmental Science and Technology, Vol 16, No 7, p 380A-384A, July, 1982. 2 Fig, 1 Ref.

Descriptors: *Biological wastewater treatment, *Films, *Trickling filters, *Anaerobic digestion, Wastewater treatment, Aerobic digestion, Methane, Filter media, Rotating biological contactors, Microorganisms, Industrial wastewater, Acclimatization.

Fixed film biological treatment systems have several advantages over the conventional activated sludge process--energy savings or net energy production, resistance to toxic materials, and smaller size. Examples are trickling filters, rotating biological contactors, and anaerobic systems. Development of improved filter media to replace gravel and stones greatly reduced the area of land required for a treatment facility. The fixed film of microorganisms forms on the surface of the shaped inert media (polyvinyl chloride, other plastics, stainless steel, redwood, etc.) and biodegrades and adsorbs polluting materials. Fixed film systems have some disadvantages such as difficulty in building up biomass in the beginning of operations (as long as 3 months), limited loading rate, and an inability to treat high waste concentrations. Most of the presently-operating systems are aerobic. Some are arranged for countercurrent flow (air or oxygen upward and wastewater flow downward) and some for crossflow. The biofilm thickness is kept under control by predators living on the filter and by hydraulic activity of the fluid flow. Anaerobic system development is currently active. Advantages include greatly reduced sludge production, generation of 70-85% methane-containing gas, no required energy input, and low nutrient requirements. It was possible to design anaerobic systems for treatment of specific industrial wastewaters such as phenol. Experimental addition of 50 mg per liter Cr(6+) to wastewater in a rotating biological contactor system affected nitrification by impairing the function of Nitrosomonas, the nitrite oxidizer. Nitrobacter, the ammonium oxidizer, was less damaged. Recovery was observed in a week. Tests of shock loads of a variety of toxic chemicals showed declines in methane production but resilient recovery to normal operation. Microorganisms acclimatizing to 10-25 times the usual harmful dose were observed. (Cassar-FRC)
W83-00191

DIGESTER CONTROL PAYS DIVIDENDS,
Hinsdale Sanitary District, IL.
J. Higgins, and D. Stoltenberg.
Water/Engineering and Management, Vol 129, No 8, p 54, 56, 58, July, 1982. 3 Fig.

Descriptors: *Anaerobic digestion, *Wastewater treatment, *Sludge digestion, Activated sludge process, Hinsdale, Illinois, Wastewater facilities, Control systems.

A sludge blanket detector was incorporated into a system for control of the supernatant liquid in an anaerobic digestion process at the Hinsdale Sanitary District Plant, Illinois. The 12 mgd activated sludge plant includes rapid sand filtration for tertiary treatment, aerobic digestion of waste activated sludge, and anaerobic digestion of all other sludges. A worksheet was divised to easily tell the operator the supernatant situation in each secondary digester, which has 3 drawoff ports. The sludge level detector is used to remotely indicate the border between clear and turbid liquid. The worksheet makes it possible to systematically

record measured liquid levels, choose the appropriate withdrawal port, and calculate the volume of supernatant and pounds of BOD in the withdrawn liquid. This permits recycling of supernatant into the headworks during periods of low organic and/or hydraulic loading, usually at night. Clay-lined lagoons are available for temporary storage. (Cassar-FRC)
W83-00192

EFFECT OF A BACTERIAL CULTURE PRODUCT ON BIOLOGICAL KINETICS,
Texas Univ. at Arlington. Dept. of Civil Engineering.
S. R. Qasim, and M. L. Stinehelfer.
Journal of the Water Pollution Control Federation, Vol 54, No 3, p 255-260, March, 1982. 8 Fig, 5 Tab, 6 Ref.

Descriptors: *Activated sludge process, *Bacteria, Performance evaluation, *Wastewater treatment, Kinetics, Biological wastewater treatment, Process efficiency.

Two identical laboratory units operating under similar conditions were used to evaluate the performance of a bacterial culture product on a continuous-flow activated sludge process. The biological kinetic coefficients were developed by operating one unit with the addition of the bacterial culture product and using the laboratory unit as a control. Bench-scale batch reactors were used to determine the optimum dosage of the bacterial culture product, while bench-scale, continuous flow activated sludge reactors were used to evaluate the biological growtt kinetics. The bacterial culture product tested was found to have some effect on the sludge growth yield coefficient and on the decay coefficient, although it had no effect on the substrate utilization coefficients. The product had little effect on the overall performance of a well-designed and well-operated activated sludge treatment plant, although it might have some benefit in plants which are already overloaded or operating at poor organic removal efficiencies. The procedure used in this study provides a systematic and rational approach to the evaluation of the effect of bacterial culture products on biological treatment plants under different operating conditions. (Carroll-FRC)
W83-00212

NON-CONTACTING ULTRASONIC FOR FLOW AND LEVEL CONTROL,
K. V. Beard.
Effluent and Water Treatment Journal, Vol 22, No 5, p 199, May, 1982.

Descriptors: *Water treatment facilities, *Ultrasonics, Design criteria, Planning, *Wastewater treatment, Measuring instruments.

Increased usage of automated plants in the treatment of both industrial waste and sewage is being seen in the water industry. One particular area of development is the control and monitoring of water and effluent levels and flow rates. The need arose for a system which would detect or measure levels without contacting the media. The system would operate continually without the need for constant checking and adjustment and it would have to be unfailingly accurate. An ultrasonic transducer package has been developed which dispenses with the need for reflectors and pre-amplifiers, produces an electronic control unit able to filter out all spurious signals, and converts the time taken for the sonic pulse to reach the media. Despite extreme sensitivity, such units are remarkably tough measuring instruments being dust and vibration proof and unaffected by rain and heat. The ultrasonic transducer package means that rather than having to send personnel down to the bottom of wet wells or sumps in which the probe is placed, the unit is freely accessible at the top of the vessel. Another development is the ultrasonic flow, or open channel, meter. By measuring with extreme accuracy the change in level in open channels or weirs, where the normal flow rate is known, one can obtain instant and extremely accurate signals of flow changes, thus initiating alarms, pumps or gauges as required. An example is offered in the West Midland sewage treatment works. (Baker-FRC)
W83-00221

COLIFORM ATTACHMENT TO SUSPENDED PARTICLES IN STORMWATER,
Michigan Univ., Ann Arbor. School of Public Health.
For primary bibliographic entry see Field 5B.
W83-00224

NUTRIENT REMOVAL FROM WASTEWATER BY WETLANDS,
North Central Forest Experiment Station, Grand Rapids, MN.
D. S. Nichols.
In: Proceedings, 6th International Peat Congress, August 17-23, 1980, Duluth, Minnesota. W.A. Fisher Company, Eveleth, Minnesota, 1981. p 638-642, 2 Fig, 1 Tab, 61 Ref.

Descriptors: *Wastewater management, *Wetlands, *Nitrogen removal, *Phosphorus removal, *Nutrient removal, *Literature review, Wastewater, Water quality, Water quality control, Wastewater disposal, Wastewater discharge, Wastewater lagoons, Wastewater treatment, Phosphorus, Nitrogen, Denitrification, Ammonium, Nitrates.

The literature on the capacity of wetlands for removing nitrogen (N) and phosphorus (P) from wastewater was reviewed and assessed. Retention of inflowing P under natural conditions appears to be limited to the relatively small amount of P that is accumulated as peat is formed from partially-decayed vegetation. Some P is absorbed by the soil when above-natural levels are added to a wetland. Wastewater P is most efficiently removed at low loading rates, and efficiency decreases rapidly as loading rates increase. Further, P removal declines with time; hence, short-term studies can give misleadingly high estimates of ultimate P removal capacity. Removal of N in excess of the natural accumulation rate in the peat is apparently by denitrification. As with P, N removal efficiency decreases rapidly as wastewater N loading rates are increased. The denitrification rate may be limited by the nitrification rate of ammonium-N, nitrate-N, or by oxygen diffusion. From the sparse literature data available, it is estimated that 1 ha of wetland would be needed to remove 75% of the P and N generated by 15 and 20 people, respectively, or to remove 54% of the P and N generated by 50 people. Hence, wetland application is feasible only where wetlands are abundant and population densities are low. Large populations cannot be served by this means. (Zielinski-MAXIMA)
W83-00226

CAUSE OF INEFFICIENT SOLIDS SEPARATION IN THE ACTIVATED SLUDGE PROCESS,
Delaware Univ., Newark. Water Resources Center.
R. I. Dick, and J. H. Johnson, Jr.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-108381, Price codes: A03 in paper copy, A01 in microfiche. Completion Report, June 1982. 32 p, 7 Fig, 4 Tab, 8 Ref. OWRT A-034-DEL(2), 14-34-0001-7016.

Descriptors: *Activated sludge process, *Particulate matter, *Clarified wastewater, *Suspended solids, *Wastewater facilities, Activated sludge, *Wastewater treatment, Sludge, Solids waste disposal, Clarification, Water treatment, Pilot plants, Sedimentation, Settling tanks, Sedimentation rates, Overflow, Effluents, Flow rates, Water treatment facilities.

Research was conducted to examine why particles are contained in clarified effluent from activated sludge final sedimentation tanks which are not subjected to solids overload, since, in principle, particles should not exist above the feed-level of underloaded sedimentation tanks. The results of this study suggested that the presence of clarified effluent particles could arise from selective removal of slow settling particles from the thickening portion of the tank, or by displacement of sludge into the clarification portion of the tank, or by displacement of sludge into the clarification portion of the tank with subsequent sedimentation of rapidly settling particles. Since pilot scale sedimentation tank inlet port diameter was found to have a significant effect on clarification performance, the latter interpretation may be appropriate. As anticipated, solids that escaped from sedimentation tanks tended to be smaller and lighter than those captured. Three aspects investigated on this study to assess the cause of solids loss were: closely-controlled pilot scale tests with a surrogate (calcium carbonate) suspension; examining solids properties captured/lost at full-scale activated sludge treatment plants; and operating a pilot-scale final sedimentation tank at an activated sludge wastewater treatment plant. High overflow rates caused a deterioration of pilot plant performance. (Zielinski-MAXIMA)
W83-00232

WASTEWATER FLOCCULATION-FILTRATION AND POST DISINFECTION,
Sulzer Bros. Ltd., Winterthur (Switzerland).
J. C. Ginocchio, H. Gros, H. Bischofberger, and A. Gmunder.
Water Services, Vol 86, No 1036, p 267-270, June, 1982. 13 Fig, 2 Tab, 4 Ref.

Descriptors: *Flocculation, *Filtration, *Disinfection, *Wastewater treatment, Bacteria, Trihalomethanes, Chlorinated hydrocarbons, Advanced wastewater treatment, Chlorination, Coliforms, Turbidity, Metals, Organic matter, Switzerland.

A flocculation-filtration granular media pilot plant was installed at a municipal wastewater treatment plant to study the elimination of coliforms, enterococci, spore-forming bacteria, viruses, parasites, and other substances present after mechanical and biological treatment. Flocculants tested were ferrous sulfate, ferric sulfate, aluminum sulfate, and aluminum polyhydroxy chloride. Turbidity was reduced from 30 to 1.5 NTU. Phosphorus removal was 80%, but it was difficult to reach a P level lower than 1 g per cu m without using a two-stage process. Removals of Fe were to less than 0.3 g per cu m; Cd, Cu, and Pb, 75%; Zn, 50%; and Ni, not removed. Levels of many organic pollutants were also substantially reduced. Bacterial levels were reduced by flocculation-filtration as follows: coliforms, from over 10 million per 100 cu cm in raw water to < 10,000 per 100 cu cm; spore-forming bacteria, from 308-842 per cu cm in raw water to < 0.1-2 per cu cm after flocculation-filtration and , 0.1-1 per cu cm after subsequent chlorination; total bacteria, from over 20,000 per cu cm in raw water to 5000 per cu cm. Chlorination post-disinfection was achieved faster and with much less residual chlorine using flocculation-filtration than with untreated effluent. The flocculation-filtration process had practically no beneficial effect on reduction of chloroform during post-chlorination. (Cassar-FRC)
W83-00239

HIGH PH STABILIZATION OF WASTEWATER SLUDGE USING CHEMICAL SOFTENING WASTES FROM WATER TREATMENT,
Iowa Univ., Iowa City. Dept. of Civil Environmental Engineering.
R. R. Dague.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-108472, Price codes: A04 in paper copy, A01 in microfiche. Iowa State Water Resources Research Institute ISWRRI-99, Iowa State University, Ames, June 1982. 59 p, 33 Fig, 1 Tab, 32 Ref. OWRT A-062-IA(2), 14-34-0001-7034.

Descriptors: *Bacterial analysis, *Hydrogen ion concentration, *Sludge, *Water treatment, *Wastewater treatment, *Alkalinity, *Sludge disposal, Coliforms, Aerobic bacteria, Disinfection, Lime Alkaline water, Chemical treatment, Water quality, Water quality control, Water softening, Wastewater renovation, Activated sludge, Streptococcus.

An alternative to the independent disposal of wastewater treatment sludge and chemical water softening sludge is to combine the two sludge types in a common system for high pH stabilization of the wastewater sludge, followed by dewatering and disposal of the combined sludge. Laboratory assessment of this alternative concluded that fecal coliform bacteria in primary wastewater sludge could be close to totally killed within one hour at pH levels ranging from pH 11.0-12.2 at 20 and 30 degrees. The pH should be maintained at no less than 11.5 for up to 24 hours. Kills of total aerobes and fecal streptococci required up to pH 12.2. Short-time exposured at pH 12 also killed microorganisms in primary and secondary activated sludge. Addition of water treatment sludge to primary wastewater sludge for combined high pH treatment reduces the make-up lime requirement and will improve filtrate and decant quality as the water/wastewater sludge ratio increases. Addition of the softening sludge to wastewater for high pH treatment did not, however, reduce lime requirements to achieve pH levels of 11.0 or 11.5. It concluded that there may be both cost and operational performance advantages to combined water and wastewater sludge treatment at high pH. (Zielinski-MAXIMA)
W83-00243

DEVELOPMENT OF CHLORINE RESISTANT MEMBRANES, POLYIMIDE MEMBRANES AND POROUS SUBSTRATES,
Membrane Systems, Inc., San Diego, CA.
For primary bibliographic entry see Field 3A.
W83-00246

A CURRICULUM FOR WATER SUPPLY AND WASTEWATER OPERATION, MAINTENANCE AND MANAGEMENT,
District of Columbia Univ., Washington. Water Resources Research Center.
For primary bibliographic entry see Field 5G.
W83-00247

WASTEWATER MANAGEMENT PROBLEMS IN RURAL COMMUNITIES,
Wisconsin Univ.-Milwaukee. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5G.
W83-00249

THE LAUREL RUN ACID MINE DRAINAGE RENOVATION DEMONSTRATION FACILITY: AN EVALUATION,
Pennsylvania State Univ., University Park. Coll. of Agriculture.
For primary bibliographic entry see Field 5G.
W83-00258

ALGAL CONCENTRATION AND SPECIES COMPOSITION IN EXPERIMENTAL MATURATION PONDS WITH EFFECTS OF AERATION AND RECIRCULATION,
National Inst. for Water Research, Pretoria (South Africa).
S. N. Shillinglaw, and A. J. H. Pieterse.
Water SA (Pretoria), Vol 6, No 4, p 186-195, October 1980. 3 Fig, 3 Tab, 16 Ref.

Descriptors: *Humus sludge, *Wastewater treatment, *Stabilization ponds, *Algal growth, *Aerated lagoons, Wastewater facilities, Wastewater disposal, Wastewater collection, Effluents, Effluent streams, Effluent seepage, Lagoons, Storage reservoirs, Water circulation, Instream aeration, Algae, Eutrophication.

Three experimental maturation pond systems receiving humus tank effluents from a conventional sewage treatment works were studied over a 12-month period. The effects of aeration and recirculation of pond water on algal concentrations was compared with no agitation of pond water. Further, the algal composition of the systems was examined with emphasis on the non-agitated (control) system. The algal concentrations of all three pond systems showed wax and wane patterns. The aerated system appeared to be the most efficient in terms of maintaining a high algal concentration. Algal concentration declined during summer and winter months in the recirculated and non-agitated systems, but only during the summer in the aerated system. Possible reasons for the observed algal concentration pulses and subsequent declines are discussed. The aerated system also had the highest mean chlorophyll a concentration, suggesting that pond water aeration was most favorable for algal growth. Aeration also reduced the number of algal concentration pulses in the system. Recirculation did not increase algal concentration. (Zielinski-MAXIMA)
W83-00284

EVALUATION AND CONTROL OF SIDESTREAMS GENERATED IN PUBLICLY OWNED TREATMENT WORKS,
Weston (Roy F.), Inc., West Chester, PA.
R. Ball, M. Harris, and K. Deeny.
Environmental Protection Agency Project Summary EPA-600/S2-82-016, May 1982. 9 p, 3 Fig, 4 Tab. 68-03-2775.

Descriptors: *Wastewater treatment, *Sidestreams, *Algorithms, Wastewater facilities, Effluents, Performance evaluation, Decision making, Design criteria.

Many performance problems at Publicly Owned Treatment Works (POTW) are allegedly the result of recycling sidestreams within the POTW. Sidestreams often carry significant quantities of organic and inorganic materials either in solution or suspended form. A process matrix was developed to categorize sidestream volumes and strengths typical of various types of POTW's. From this matrix, the impact of the sidestreams on overall POTW performance and effluent quality was determined, and operational evaluation and control procedures and design information to minimize their impact were developed. Evaluation algorithms were developed to evaluate mainstream treatment processes primarily with respect to the impact of sidestreams. Control algorithms were developed to be used as guides in making operational changes at the mainstream and sidestream processes to control the impact of the sidestreams. Through the proper use of the algorithms, a point is reached where all applicable operational methods to reduce the sidestream impact have been performed. Decision points included in the algorithms refer the user to design methods to control sidestream impacts in the event that all of the operational methods have been unable to reduce the impacts to acceptable levels. (Moore-SRC)
W83-00291

SLUDGE DISPOSAL FROM ACID MINE DRAINAGE TREATMENT,
Bureau of Mines, Pittsburgh, PA. Pittsburgh Research Center.
For primary bibliographic entry see Field 5E.
W83-00298

INSTRUMENTAL METHODS OF MONITORING AND CONTROL OF WATER AND WASTEWATER TREATMENT PROCESSES,
Taylor (John) and Sons, London (England).
For primary bibliographic entry see Field 5F.
W83-00314

PRELIMINARY STUDIES ON THE TREATMENT OF CANNING FACTORY EFFLUENT WITH AN INTEGRATED BACTERIAL-ALGAL-FISH SYSTEM,
Orange Free State Univ., Bloemfontein (South Africa). Inst. for Environmental Sciences.
I. G. Gaigher, T. E. Cloete, and D. F. Toerien.
Water SA, Vol 8, No 2, p 97-100, April, 1982. 4 Fig, 1 Tab, 11 Ref.

Descriptors: *Food-processing wastes, *Algae, *Bacteria, *Wastewater treatment, Canneries, Photosynthetic bacteria, Fish, Organic wastes.

A bacterial-algal-fish system decreased the COD of a canning factory effluent by 98%. The effluent had a mean pH of 4.5, BOD of 528 mg per liter, and COD of 3116 mg per liter. The waste matter was fermented on a laboratory scale for 24 hours at 37 C to produce a fatty acid mixture, which was in turn subjected to 8 days retention in a photosynthetic bacterial unit and 8 days in an algal unit. The resulting algal mass was fed to fish, Oreochromis mossambicus. Mean COD and BOD (in mg per liter) at the different stages were: end of bacterial unit treatment, 225 and 170, respectively; and end of algal growth, 60 and 41, respectively. Mean total suspended solids (in g per liter) were 1.3 in the canning effluent, 1.8 in the photosynthetic bacteria unit, and 0.09 in the algal unit. Final pH was 7.8. The water from the algal unit met South African standards for drinking water with respect to BOD, COD, phosphate, and ammonium. (Cassar-FRC)
W83-00317

TREATMENT OF OILY WASTEWATERS FROM ONSHORE OPERATIONS,
Rockwell International, Newbury Park, CA. Environmental Monitoring and Services Center.
I. Lysyj.
Journal of the Water Pollution Control Federation, Vol 54, No 3, p 309-315, March, 1982. 1 Fig, 5 Tab, 3 Ref.

Descriptors: *Wastewater treatment, *Oily water, *Water pollution control, Ships, Wastewater facilities, Oil pollution, Industrial wastewater, Performance evaluation, Hydrocarbons, Ballast, *Alaska.

The operations of the Port Valdez, Alaska, facility for the treatment of ballast water from oil tankers were studied in order to determine the capabilities and limitations of a modern state-of-the-art oil waste treatment plant in dealing with ever-increasing quantities of waste from energy-related operations. The Port Valdez facility utilizes primary treatment by gravity separation under quiescent aging conditions in above-ground and steel-cone-roof storage tanks, followed by a secondary treatment consisting of a chemically aided flocculation and a dissolved air flotation process (with capability for a final pH adjustment) plus an effluent impoundment basin. The treatment plant was found to be effective in reducing the free oil content of the ballast water, achieving a 99.8% reduction in the organic load. Most of the organic content reduction was achieved in the gravity separator, with the dissolved aeration-flotation unit adding relatively little to the treatment process. The average concentration level for aromatic hydrocarbons was found to be 9 milligrams carbon per liter in the primary effluent and 5 milligrams carbon per liter in the final effluent. Since the volume of ballast water treated at the Port Valdez facility is about 15 million gallons per day, significant amounts (about 70 gallons per day) of aromatic hydrocarbons are discharged daily by the plant. (Carroll-FRC)
W83-00319

POTENTIAL APPLICATIONS OF WATER HYACINTH FOR WATER, AIR RECYCLING IN CLOSED SYSTEMS,
Maryland Eastern Shore Univ., Princess Anne. Dept. of Natural Science.
For primary bibliographic entry see Field 5G.
W83-00324

SECONDARY TREATMENT.
Public Works, Manual, p D27-D35, 1982.

Descriptors: *Secondary wastewater treatment, *Suspended solids, *Organic matter, *Activated sludge process, *Aeration, *Oxidation, *Biological filters, Filters, Wastewater oxidation, Trickling filters, Mechanical equipment, Wastewater treatment, Activated sludge, Oxidation ponds, Biological oxidation, Rotating disc filters.

Secondary treatment of wastewater for the removal of fine suspended solids and dissolved organic matter is discussed. The activated sludge process can utilize equipment for diffused aeration, mechanical aeration, combined aerators and clarifiers and steel basin fabricators, and modified activated sludge components. Reaeration of sewage and

oxygen application are discussed. Oxidation basins or ponds can utilize sludge removers, aeration equipment, and pond liners. Equipment for biological filters including trickling filters and rotating biological filters includes filter bed materials, drainage floors, and distributors. Manufacturers and suppliers are listed for most of the equipment discussed. (Small-FRC)
W83-00325

ANAEROBIC DIGESTION OF FREE VOLATILE FATTY ACIDS IN SOILS BELOW WASTE TIPS,
Institute for Land and Water Management Research, Wageningen (The Netherlands).
J. Hoeks, and R. J. Borst.
Water, Air, and Soil Pollution, Vol 17, No 2, p 165-173, 1982. 5 Fig, 3 Tab, 11 Ref.

Descriptors: *Leachates, *Volatile acids, *Fatty acids, Soil columns, Sanitary landfills, Soil types, Anaerobic digestion, Fermentation, Methane.

Complex organic compounds are fermented anaerobically during the acidification stage in the fermentation of a landfill, yielding free volatile fatty acids and other products. Since this acidification stage may last several years, much attention has been given to the behavior of the free volatile fatty acids leached to the soils below landfills. Soil column experiments were conducted to evaluate the effects of free volatile fatty acid concentration and soil type on the removal of these acids in soil by methane fermentation. These experiments demonstrated that removal of these acids by this process can be quite effective, especially in soils with a high buffering capacity, and that the maximum allowable concentrations of volatile fatty acids for methane fermentation in soils is much higher than previous studies indicated. The limiting concentration for a sandy loam soil, in which the retention time was only 17 days, exceeded 6,500 milligrams per liter of acetic acid equivalents. Methane fermentation was impeded in all soil types at about 25,000 milligrams per liter of acetic acid equivalents. In sandy soils with a low buffering capacity, the methane fermentation was already limited at rather low acid concentrations. When the pH of the leachate is buffered at between pH 6. 5 and 7.0, methane fermentation can be very efficient, especially at the long soil retention times common for field conditions. In such cases, the volatile fatty acids will generally be completely removed from the leachate in the upper meter of soil. (Carroll-FRC)
W83-00326

THE INFLUENCE OF PROCESS PARAMETERS ON THE REMOVAL OF HEAVY METALS IN ACTIVATED SLUDGE,
Imperial Coll. of Science and Technology, London (England). Public Health Engineering Lab.
A. C. Rossin, R. M. Sterritt, and J. N. Lester.
Water, Air, and Soil Pollution, Vol 17, No 2, p 185-198, 1982. 7 Fig, 5 Tab, 34 Ref.

Descriptors: *Heavy metals, *Activated sludge process, *Wastewater treatment, Process efficiency, Performance evaluation, Biological treatment, Solubility, Cadmium, Copper, Nickel, Lead, Chromium, Zinc.

The effect of sludge age on metal removal efficiencies and metal uptake by the activated sludge biomass and the importance of heavy metal solubility and speciation in the behavior of heavy metals in the activated sludge process were investigated. The fates of normal and elevated influent concentrations of six heavy metals were studied in an activated sludge pilot plant. The addition of soluble heavy metal salts to settled sewage resulted in consistently higher percentage removals of heavy metals at sludge ages of 4, 9, and 12 days, possibly as a result of lesser variations in heavy metal speciation in the settled sewage. The greatest degree of accumulation of heavy metals by the biomass occurred at the 12 day sludge age. Effluent concentrations of heavy metals did not immediately rise in proportion to the introduction of shock loads of these metals into the system. Heavy metal removal efficiencies were found to be similar under steady state conditions of normal and elevated influent metal concentrations. Cadmium, copper, and nickel were largely soluble in the effluent samples, but chromium, lead, and zinc were predominantly insoluble, indicating that particulate forms of these metals may escape removal in secondary sedimentation. The consistently poor removal of nickel in the activated sludge process was reflected in its high degree of solubility in the settled sewage and final effluent. The two most soluble metals, copper and nickel, appeared to be associated to a large extent with high molecular weight substances in the settled sewage and final effluent, possibly influencing their availability for uptake by the biomass. (Carroll-FRC)
W83-00327

DAILY CHEMICAL VARIABILITY OF DOMESTIC SEPTIC TANK EFFLUENT,
Commonwealth Scientific and Industrial Research Organization, Wembley (Australia). Div. of Land Resources Management.
B. R. Whelan, and Z. V. Titamnis.
Water, Air, and Soil Pollution, Vol 17, No 2, p 131-139, 1982. 1 Fig, 8 Tab, 14 Ref.

Descriptors: *Chemical composition, *Septic tanks, *Domestic wastes, Trace metals, Nitrogen, Phosphorus, Chemical analysis, Conductivity, Oxidation-reduction potential, *Australia, Fate of pollutants.

Although the use of septic tanks for the disposal of liquid domestic waste is very common in Australia, very little information on the composition of septic tank effluent in Australia has been published. Septic tank effluents from five households, representing a range of family situations, were sampled daily for 15 days. Measurements were made of temperature, redox potential, conductivity, and 5-day biochemical oxygen demand. Samples were analyzed for nitrogen, phosphorus, calcium, magnesium, sodium, potassium, copper, zinc, cadmium, chromium, lead, manganese, and linear alkylate sulfonate (LAS). While there were differences among the households with respect to the effluent composition, these differences were small. Values were most different for the household consisting of an elderly couple who diverted some of their waste waters to their garden. Little variation occurred in the effluent from any one household over the 15 days covered. The effluent was in a reduced and anaerobic condition, with almost all of the nitrogen and phosphorus occurring in the inorganic form in solution, placing a great dependence on the soil for reduction of these chemicals. The effluent contained about 100 milligrams of nitrogen per liter and about 15 milligrams of phosphorus per liter, giving a mean annual loading for the five households of about 3.8 kilograms of nitrogen per liter and about 15 milligrams of phosphorus per liter, giving a mean annual loading for the five households of about 3.8 kilograms of nitrogen and 0.6 kilograms of phosphorus per person per year. Copper and zinc, which were the only trace metals of any significance in the effluent, were less concentrated in the effluent than in the tap water from the households sampled. Comparisons with data from other countries showed that the chemical composition of the septic tank effluent was very similar to that found in New Zealand, Canada, and the United States. (Carroll-FRC)
W83-00328

PRIMARY TREATMENT.
Public Works, Manual, p D18-D27, 1982.

Descriptors: *Primary wastewater treatment, *Screens, *Sedimentation, *Industrial wastewater, *Suspended solids, Clarification, Clarifiers, Filtration, Filters, Settling basins, Flotation, Flocculation, Mechanical equipment, Wastewater treatment.

Primary wastewater treatment processes are discussed, including screening of large floating objects and sedimentation of grit. Screening techniques consist primarily of coarse screens, including automatic or manual rakes. Fine screens are useful in industrial wastewater treatment and include disc screen, drum screens, and vibrating screens. Grit collection is implemented through the use of channel collectors and various types of washing collectors. Grit and screenings disposal equipment is also reviewed. After screening and grit removal, clarification equipment is usually used, including settling tanks, flotation, flocculation, and thickeners. Suppliers are listed for factory built sewage treatment units and components as well as for most of the equipment discussed. (Small-FRC)
W83-00337

ADVANCED BIOLOGICAL TREATMENT TO ACHIEVE NUTRIENT REMOVAL,
Reedy Creek Utilities Co., Inc., Lake Buena Vista, FL.
C. R. Burdick, D. R. Refling, and H. D. Stensel.
Journal of the Water Pollution Control Federation, Vol 54, No 7, p 1078-1086, July, 1982. 7 Fig, 7 Tab, 23 Ref.

Descriptors: *Advanced wastewater treatment, *Nutrient removal, *Biological wastewater treatment, *Wastewater treatment, Bardenpho process, Nitrogen removal, Denitrification, Fermentation, Palmetto, *Florida, Cost analysis, Phosphorus removal.

An advanced biological treatment system in Palmetto, Florida, uses the Bardenpho Process (BARnard, DENitrification, PHOsphate), which removes N and P without addition of a chemical energy source for the microorganisms. It consists of a fermentation zone followed by a four-stage, complete-mix activated sludge process with alternating anoxic and aerobic conditions. Since January 1980, this plant has achieved 99% removal of BOD and suspended solids, 93.4% removal of total N, and 65-70% removal of total P. Average operating conditions are 1.22 mgd, 13.3 hours detention time, 164 mg per liter influent BOD, 143 mg per liter influent suspended solids, 32 mg per liter influent total N, and 8.4 mg per liter influent P. Initial construction costs were $1,925,700 for the Bardenpho process and $2,197,000 for the conventional process. Equivalent annual costs were $289,014 and $405,379 respectively. A Bardenpho process with design capacity of 1 mgd would cost 13% more than an extended aeration activated sludge system. (Cassar-FRC)
W83-00349

MUNICIPAL PRETREATMENT PROGRAM DEVELOPMENT,
Brown and Caldwell, Walnut Creek, CA.
R. V. Cooley, R. M. Hunter, R. P. Sheridan, and J. J. Simmler.
Journal of the Water Pollution Control Federation, Vol 54, No 7, p 1067-1077, July, 1982. 2 Fig, 7 Tab, 10 Ref.

Descriptors: *Industrial wastewater, *Planning, *Monitoring, *Wastewater treatment, Effluent standards, Effluent limitations, Regulations, Municipal wastewater, Legal aspects, Financing, Law enforcement, Public participation, Saline water.

The requirements and development of a publicly owned treatment works (POTW) pretreatment program are described. The POTW must have the legal authority to control changes in pollutant concentration or volume, require compliance with standards, carry out surveillance, and assess penalties for noncompliance. Procedures to ensure compliance must be available. Adequate finances, personnel, and equipment are needed to carry out the program. Elements of program development include an industrial inventory, establishment of pretreatment limitations, a monitoring enforcement program, arrangements with legal authorities, appropriate funding and and information program to educate industry and the general public. Three case histories illustrate development of toxic limitations, control of operational problems, and analysis of control measures. Santa Cruz, California, established rational discharge limits by performing mass balances on the pretreatment works to determine allowable influent concentrations that satisfied effluent standards and did not exceed the plant's design limitations. Clark County, Nevada, developed a program to determine the contribution of

pollutants from all users, domestic and industrial, and evaluate several treatment options. Operational problems at Albany, Georgia, were solved after an industry monitoring program determined that two industries out of 44 were responsible for most of the problems. The Metropolitan Seattle, Washington, pretreatment program development was presented as an illustration of the entire planning process. (Cassar-FRC)
W83-00350

5E. Ultimate Disposal Of Wastes

CHARACTERIZATION OF PLUTONIUM IN GROUND WATER NEAR THE IDAHO CHEMICAL PROCESSING PLANT,
Geological Survey, Lakewood, CO.
For primary bibliographic entry see Field 5B.
W83-00019

OBSERVATIONS ON THE BIOACCUMULATION POTENTIAL OF THORIUM AND URANIUM IN RAINBOW TROUT (SALMO GAIRDNERI),
Pacific Northwest Lab., Richland, WA. Dept. of Ecological Sciences.
For primary bibliographic entry see Field 5C.
W83-00021

GEOHYDROLOGIC DESCRIPTIONS OF SELECTED SOLID-WASTE DISPOSAL SITES,
Geological Survey, San Juan, PR. Water Resources Div.
For primary bibliographic entry see Field 5B.
W83-00072

WATER AND WASTE MANAGEMENT IN THE CANADIAN MEAT AND POULTRY PROCESSING INDUSTRY.
Stanley Associates Engineering Ltd., Edmo Edmonton (Alberta); and Dearborn Environmental Consulting Services, Mississauga (Ontario).
For primary bibliographic entry see Field 3E.
W83-00082

SOLID WASTE MANAGEMENT IN SOUTH AFRICA,
National Inst. for Water Research, Pretoria (South Africa).
For primary bibliographic entry see Field 5G.
W83-00090

HYDROGEOLOGY AND RESULTS OF INJECTION TESTS AT WASTE-INJECTION TEST SITES IN PINELLAS COUNTY, FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
For primary bibliographic entry see Field 5B.
W83-00129

SLUDGE DIGESTION AND DISPOSAL.
For primary bibliographic entry see Field 5D.
W83-00152

THE EFFECTS OF THE DISPOSAL OF SEWAGE EFFLUENTS ON GROUNDWATER QUALITY IN THE UNITED KINGDOM,
Water Research Centre (England).
K. M. Baxter.
Water Services, Vol 86, No 1035, p 219-220, May, 1982. 1 Fig, 2 Tab.

Descriptors: *Land disposal, *Groundwater pollution, *Soil disposal fields, *Wastewater disposal, Nitrification, Denitrification, Phosphorus, Groundwater recharge, Heavy metals, Water pollution sources, Bacteria, Organic matter, Dichlorobenzene, Phthalates, Alkenes, Steroids, *United Kingdom.

The long-term effectiveness of the unsaturated and saturated zones in improving recharged effluent quality was investigated in Britain, along with the effect of effluent recharge on the aquifer itself. A field study at nine sites studied temporal variations in natural and contaminated groundwater levels and water quality using wells and boreholes. Natural processes operating in the soil and in the unsaturated zone treated the effluent to a considerable degree, particularly in the removal of nitrogen, phosphorus, heavy metals, microbes, and soluble organic material. In the saturated zone, dilution by groundwater was the major treatment. Enteroviruses and pathogenic bacteria were all substantially removed during infiltration, and nitrification and denitrification did occur within unsaturated zones. Persistent compounds within groundwater were various trace-organics including dichlorobenzene, various phthalates, high boiling point alkenes, and steroids. (Small-FRC)
W83-00220

LAND APPLICATION OF MUNICIPAL SLUDGE WITH REGARD TO CROPPING SYSTEMS AND POLLUTION POTENTIAL,
Rutgers-the State Univ., New Brunswick, NJ. Center for Coastal and Environmental Studies.
A. J. Higgins, S. J. Toth, and M. E. Singley.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-108399, Price codes: A04 in paper copy, A01 in microfiche. Center for Coastal and Environmental Studies, Report NJAES No R-03141-10-82, April 1982. 54 p, 27 Fig, 10 Tab, 2 Ref. OWRT A-057-NJ(1), 14-34-0001-1132.

Descriptors: *Land disposal, *Municipal wastes, *Cultivate lands, *Sludge disposal, *Crop production, *Application rates, *Pollution, Sludge, Fertilizers, Solid wastes, Solid waste disposal, Waste disposal, Fertilization, Crop yield, Agriculture, Farming, Wastewater, Water quality standards, Trace elements, Heavy metals.

A study was undertaken to demonstrate the potential benefits in using sewage sludge as a soil conditioner/fertilizer on productive agricultural soils in New Jersey. Aerobically-digested liquid sewage sludge was applied to Sassafras sandy loam soil at rates of 0,22.4, and 44.8 metric tons/ha, in the spring of 1977, 1978, and 1979. Groundwater, soil, and crop contamination levels were monitored to determine the maximum sewage solids loading rate permissable without causing environmental deterioration. An application of 22.4 metric tons/ha (10 tons/acre) of East Windsor sludge was determined to be the upper limit for ensuring protection of groundwater quality, according to the Federal drinking water standard for nitrate nitrogen. Application rates between 11.2-16.7 metric tons/ha were found sufficient for providing plant nutrients for the dent corn and rye cropping system studied. It must be recognized, however, that the use and disposal of sludge are two interdependent considerations of sludge management, and that both of these operations must be considered in specifying appropriate application rates. Of the trace heavy elements analyzed, iron and zinc levels (24 and 1.3 ppt, respectively) were the highest in the sludge. No heavy metals were sufficiently high to be detrimental to plant growth. Heavy metal levels are also determined in the crops and soil. (Zielinski-MAXIMA)
W83-00233

GEOLOGIC CRITERIA IN WASTE-MANAGEMENT SITE SELECTION IN NORTHEASTERN NORTH DAKOTA,
Alberta Research Council, Edmonton. Geology Div.
S. R. Moran, and B. M. Arndt.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-108423, Price codes: A04 in paper copy, A01 in microfiche. North Dakota Water Resources Research Inst., Fargo, Completion Report, 1979. 46 p, 8 Fig, 41 Ref. OWRT A-040-NDAK(1), 14-34-0001-5034.

Descriptors: *Waste management, *Landfills, *Site selection, *Soil characteristics, *Geologic mapping, *North Dakota, Solid wastes, Waste disposal, Land disposal, Waste dumps, Sites, Contamination, Pollutants, Pollution load, Lagoons, Geological surveys, Waste storage, Waste assimilative capacity.

A review of existing geological mapping in eastern North Dakota (ND) and an evaluation of the various surface material characteristics as they influence suitability for sanitary landfill and stabilization-lagoon waste disposal were carried out. In the climatic setting of eastern ND, hydrologic confinement of liquid/solid waste can be best achieved by locating waste-management facilities in fine-grained and unfractured sediment (e.g., glacial till, lacustrine silt, or clay). Steep slope areas are best avoided due to the steeper hydraulic gradients encountered. Since discontinuities between different layers of till (marking former land surfaces) provide more permeable conduits for contaminant escape, the thickness of the surface till layer is important in waste management facility location. Where constructural relief on the surface layer of superglacial sediment that covers most of eastern ND is less than about 4 m, the base of a 5 m deep excation is expected to encounter the surface layer base and permit contaminant escape. The evaluation principles of a proposed landfill/lagoon suitability are discussed. The results of this study, with existing geological mapping, will aid potentially suitable site selection requiring a minimum of engineering modifications and maintenance to acceptably confine wastes, and also assist evaluation of acceptability of currently proposed sites. (Zielinski-MAXIMA)
W83-00236

HIGH PH STABILIZATION OF WASTEWATER SLUDGE USING CHEMICAL SOFTENING WASTES FROM WATER TREATMENT,
Iowa Univ., Iowa City. Dept. of Civil Environmental Engineering.
For primary bibliographic entry see Field 5D.
W83-00243

HAZARDOUS WASTE TECHNOLOGY TRANSFER ASSESSMENT,
Pennsylvania State Univ., University Park. Inst. for Research on Land and Water Resources.
C. A. Marro, and W. E. Sharpe.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-108134, Price codes: A05 in paper copy, A01 in microfiche. Completion Report, June, 1982. 68 p, 4 Append. OWRT C-00192-T(0496)(2), 14-34-0001-0496.

Descriptors: *Technology transfer, *Hazardous materials, *Surveys, *Land disposal, *Waste disposal, Technology, Poisons, Toxins, Computer models, Leachates, Wastewater disposal, Public participation, Wastes, Waste management, Waste load, Groundwater pollution, Environmental protection.

An assessment was made of hazardous waste disposal technology transfer to determine the need for and suitability of information, and to identify people needing this information and the best means of providing it for their use. The scope of groundwater contamination is discussed, and disposal techniques and current regulations for groundwater protection are outlined. The information search strategy included a literature search, consultation with computerized information files, and contact with groundwater and waste disposal experts and with government agencies. Groups/individuals who may use disposal technology are identified and characterized, and user needs (technical information level, publication format) are discussed. Significant research and technology transfer products and their strengths and weaknesses are identified, including the agency/association/corporation sources for these products. Recommendations are made for three needed technology transfer products: a semi-technical report on a developed improved model for estimating dispersion coefficients; a non-technical report on permeability of liners used in land-fills; and public education packet presenting rational objective information on groundwater flow and contamination. Cost-benefit analyses are included where appropriate. (Zielinski-MAXIMA)
W83-00276

SPREADING LAGOONED SEWAGE SLUDGE ON FARMLAND: A CASE HISTORY,

Purdue Univ., Lafayette, IN.
C. M. Robson, and L. E. Sommers.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-181082, Price codes: A06 in paper copy, A01 in microfiche. Environmental Protection Agency Project Summary EPA-600/S2-82-019, May 1982. 3 p, 1 Tab. C2575NASX.

Descriptors: *Cropland, *Land disposal, *Sludge disposal, *Public relations, Corn, Soybeans, Cadmium, Polychlorinated biphenyls, Public opinion.

When the city of Indianapolis, Indiana, was required to construct advanced wastewater treatment facilities at the existing Belmont Wastewater Treatment Plant, it was determined that the most cost effective site was the 10 sludge lagoons containing 420,000 cu m of digested sewage sludge for up to 50 years. The major portion of the sludge (265,000 cu m) was disposed of by application to privately owned cropland in adjacent Boone County. Cadmium and polychlorinated biphenyl (PCB) contents of the sludge were the major constraints in determining the sludge application rates to the cropland. Frequent analyses of the sludge solids were needed to identify the appropriate rates. Landowners consigned about 5,000 ha for a single sludge application, after which corn and soybeans were grown. An effective public relations program minimized public resistance and secured the cooperation of area residents. Analysis revealed no measurable increases in the Cd and PCB contents of the grain after the single sludge application. Techniques were developed for removing, transporting, and applying lagooned sludges and for administering and monitoring such a program. (Moore-SRC)
W83-00296

SLUDGE DISPOSAL FROM ACID MINE DRAINAGE TREATMENT,
Bureau of Mines, Pittsburgh, PA. Pittsburgh Research Center.
T. E. Ackman.
Bureau of Mines Report of Investigations RI 8672, 1982. 28 p, 7 Fig, 8 Tab, 6 Ref, 1 Append.

Descriptors: *Sludge disposal, *Acid mine drainage, *Wastewater treatment, *Coal mines, Mine wastes, Industrial wastewater, Underground waste disposal, Land disposal, Land reclamation, *Pennsylvania, *Treatment facilities.

Acid mine drainage (AMD) treatment plants (33), operated by 11 Pennsylvania coal companies, were randomly surveyed for information on sludge volume, sludge settling, transportation and disposal. Of the 33 treatment plants, 6 treated water from abandoned workings, 7 treated water from mines scheduled to close within the next 5 years, 4 treated water from mines scheduled to close within 5 to 10 years, 7 treated water from mines scheduled to close within 10 to 20 years, and 9 treated water from mines scheduled to close after that. Onsite visits allowed observation of problems associated with the various methods of sludge disposal: disposal into a deep mine; permanent retention in ponds; disposal at an active coal refuse area; and onsite burial. Deep mine disposal is the most frequently used method and the most environmentally sound. It is apparent that the magnitude of sludge production is such that an aggressive and directed effort in reduction of sludge volume is seriously needed. The areas of major concern are the amount of surface land required for sludge storage and disposal, reclamation of these disturbed surface areas, and effective and efficient means of removing, transporting, and disposing of AMD sludge. Better water-handling procedures, to prevent acidification of mine waters, must be developed and universally applied. Where an irreducible volume of water must be treated, treatment should be such as to provide a dense, easily handled, and readily disposable sludge. (Moore-SRC)
W83-00298

WATER QUALITY CRITERIA AND EFFLUENT REQUIREMENTS IN BROWARD COUNTY, FLORIDA,
Montgomery (James M.), Inc., Pasadena, CA.
For primary bibliographic entry see Field 5G.
W83-00320

ANAEROBIC DIGESTION OF FREE VOLATILE FATTY ACIDS IN SOILS BELOW WASTE TIPS,
Institute for Land and Water Management Research, Wageningen (The Netherlands).
For primary bibliographic entry see Field 5D.
W83-00326

5F. Water Treatment and Quality Alteration

THE WATER SUPPLY OF THE BRUSSELS URBAN AREA AND ITS SURROUNDINGS.
Aqua, No 3, p 18-19, 21, 23, 27, 1982. 6 Fig.

Descriptors: *Water supply, *Municipal water, *Water storage, *Brussels, *Belgium, *Water treatment, Water distribution, Water transport, Reservoirs, Groundwater storage, Water quality control, Potable water, Drinking water.

The water treatment and distribution system of the Brussels, Belgium, urban area serves over 2 million inhabitants with an average of 310,000 cu m of water per day. Since 1973 water from the River Meuse has been added to the groundwater supplies, which include underground sand draining galleries, catchments in the limestone hills, water from an abandoned pyrite mine, water in unused quarries, and wells. The surface water treatment plant at Tailfer uses filtration, sulfuric acid for pH correction, chlorination, chlorine dioxide to decompose humic matter, alum, activated silica, activated carbon, caustic soda pH correction, settling, filtration in finely ground flint, and ozonation. This process is described in detail. The water supply system includes a computer-controlled central dispatching system, seven distribution networks and modern water quality control. (Cassar-FRC)
W83-00020

CHEMICAL STABILITY OF WATER.
Pretoria, South Africa, National Inst. for Water Research, Pretoria (South Africa).
Information Sheet I-WAT-10, February 1980. 3 p.

Descriptors: *Scaling, Water properties, *Corrosion control, *Water conveyance, *Chemical treatment, Chemical degradation, Chemical properties, Corrosion, Boreholes, Water quality control, Deterioration, Fouling, Metal pipes, Plastic pipes, Water distribution, Heated water, Water purification, Inhibitors, *Water treatment.

Stability problems, their causes and prevention, and methods for stability determination and control are briefly reviewed. Water which is chemically stable is generally neither corrosive nor scale-forming. Water stability depends on its pH, alkalinity, temperature, hardness, and the concentration and nature of its dissolved constituents (total dissolved solids). Problems caused by corrosion and scale formation often occur in distribution systems, such as in corrosion in pipes and scaling in hot water systems. Stability control in distribution systems is, hence, of crucial importance. It was concluded that, under normal conditions, the stability of water for domestic use can be controlled to a reasonable degree, and that scaling in hot water systems and corrosion of metal parts can be reduced but not wholly eliminated. Treatment of corrosive borehole (BH) water involves pumping and transportation using plastic components/pipe and contact with a column of calcium carbonate; treatments of scale-forming BH water can involve ion-exchange, lime softening, or the use of chemical inhibitors. Factos contributing to corrosion (anionic/cationic corrosivity ratio, dissolved gases, use of metal devices/pipes for water purification/transportation) and its prevention are considered. (Zielinski-MAXIMA)
W83-00091

DESIGN AND CONSTRUCTION OF THE PENNICHUCK WATER TREATMENT PLANT: THE ENGINEER'S VIEW,
Anderson-Nichols and Co., Inc., Boston, MA.
L. W. Long.
Journal of the New England Water Works Association, Vol 96, No 2, p 97-99, 1982.

Descriptors: *Construction, *Cost analysis, *Water treatment facilities, Design criteria, Water treatment, Pennichuck Water Works, Nashua, *New Hampshire, Economic aspects.

Steps in design and construction of the Pennichuck Water Works plant, New Hampshire, began with cost analysis. Preliminary planning involved preselected major process equipment components. After site subsurface explorations had been completed, scale plans and sections were prepared and submitted for criticism and revision. Disposal of backwash water and sludge was not resolved immediately. For a 5-year period this material is being sent to the municipal wastewater plant. Several cost saving innovations emerged through the project, for example, locating the plant to take advantage of gravity flow. (Cassar-FRC)
W83-00135

DESIGN AND CONSTRUCTION OF THE PENNICHUCK WATER TREATMENT PLANT: THE CONSTRUCTION MANAGER'S VIEW,
White (R. H.) Construction Co., Inc., Auburn, MA.
R. T. Koopman.
Journal of the New England Water Works Association, Vol 96, No 2, p 100-103, 1982.

Descriptors: *Construction, *Contracts, *Water treatment facilities, Design criteria, Water treatment, Pennichuck Water Works, Nashua, *New Hampshire, Cost analysis, Critical path analysis, Planning, Management.

A construction management contract was drawn up for construction of the Pennichuck Water Works plant, serving Nashua, New Hampshire. The team consisted of the owner, engineer (consulting engineer plus process manufacturer), and construction manager. A guaranteed maximum price contract for $7 million was negotiated between the construction company and the owner. The most critical part of the job was getting the structure closed before winter so that work could proceed inside. A Critical Path Method was vital as a flexible guide. Advantages of this contract arrangement include good communications, freedom of expression, and use of value engineering. (Cassar-FRC)
W83-00136

NEW EPA SODIUM AND CORROSION REGULATIONS: THEIR BASIS AND IMPACTS,
Camp, Dresser, and McKee, Inc., Boston, MA.
For primary bibliographic entry see Field 5G.
W83-00137

DEVELOPING AND APPLYING INTERNATIONAL WATER QUALITY GUIDELINES,
Pan American Health Organization, Washington, DC.
For primary bibliographic entry see Field 5G.
W83-00167

RAPID-MIX DESIGN FOR MECHANISMS OF ALUM COAGULATION,
Montana State Univ., Bozeman. Dept. of Civil Engineering and Engineering Mechanics.
A. Amirtharajah, and K. M. Mills.
Journal of the American Water Works Association, Vol 74, No 4, p 210-216, April, 1982. 11 Fig, 29 Ref.

Descriptors: *Alum, *Chemical coagulation, *Water treatment, Mixing, Design criteria, Process efficiency, Performance evaluation.

The rapid-mix unit provides the hardware necessary for the initial stages of the alum coagulation process in water treatment facilities. Information

on the basic hydrodynamic parameters, geometry, and molecular structure of the water to be treated and on the kinetics of the chemical processes that occur can be used to improve the design of rapid mixers. Recent work has made it possible to generalize zones of slow coagulation, rapid coagulation, no coagulation, and restabilization on the stability diagram for alum coagulation. This study investigated the type of rapid mixing necessary to specific regions of the stability diagram to facilitate the tailoring of the design of rapid mix operations to the predominant mode of alum coagulation. The diagram for alum stability and coagulation was used to predict specific alum doses and pH where optimum coagulation would occur. A design and operation diagram for practical use in predicting and analyzing optimum conditions for alum coagulation was then developed which tailors the design of the rapid mix unit to the predominant mode of alum coagulation. High-intensity mixing made a significant difference in the adsorption-destabilization zones, but not in the zone where sweep coagulation dominates. A back mix reactor or a blender was adequate for most conditions. (Carroll-FRC)
W83-00170

ADSORPTION OF TOXIC AND CARCINOGENIC COMPOUNDS FROM WATER,
Michigan Univ., Ann Arbor. Dept. of Environment and Water Resources Engineering.
W. J. Weber, Jr., and M. Pirbazari.
Journal of the American Water Works Association, Vol 74, No 4, p 203-209, April, 1982. 15 Fig, 3 Tab, 31 Ref.

Descriptors: *Water treatment, *Activated carbon, *Carcinogens, *Toxins, Adsorption, Mathematical models, Simulation analysis, Performance evaluation, Trace levels, Organic compounds, Water reuse, Agricultural chemicals, Wastewater renovation.

Successive reuse of water in many areas has led to the accumulation of persistent toxic and carcinogenic organic compounds of industrial or agricultural origin in many water sources and supplies, frequently at levels that pose health hazards. Granular activated carbon treatment can remove many of these compounds. However, efficient, cost effective applications of this technique require the establishment of rigorous data bases that characterize specific system dynamics. Information from these data bases must then be incorporated into plant design and operation. The Michigan Adsorption Design and Application Model is being used for data synthesis and for simulation and prediction of the performance of carbon beds in removing trace quantities of specific toxic or carcinogenic compounds under conditions approximating water treatment practice. This model has been applied to evaluation of the adsorption characteristics of benzene, p-dichlorobenzene, carbon tetrachloride, dieldrin, and two polychlorinated biphenyls. Experimental fixed-bed adsorber studies were designed to investigate dynamic adsorption behavior and to obtain data for simulation and predictive modeling of the breakthrough characteristics of each of the compounds. Reasonable agreement was demonstrated between experimental fixed-bed adsorber behavior and model predictions of breakthrough profiles for benzene, carbon tetrachloride, and p-dichlorobenzene, but not for the two polychlorinated biphenyls. No significant breakthrough was achieved with the dieldrin. (Carroll-FRC)
W83-00171

REMOVING SOLUBLE ORGANIC CONTAMINANTS BY LIME-SOFTENING,
Illinois Univ. at Urbana-Champaign. Dept. of Civil Engineering.
S. J. Randtke, C. E. Thiel, M. Y. Liao, and C. N. Yamaya.
Journal of the American Water Works Association, Vol 74, No 4, p 192-202, April, 1982. 14 Fig, 14 Tab, 61 Ref.

Descriptors: *Organic matter, *Solutes, *Water treatment, *Wastewater treatment, Chemical treatment, Lime, Water softening, Fulvic acids, Humic acids, Drinking water.

Although lime-soda softening is frequently used in the treatment of municipal and industrial water supplies and the treatment of wastewaters to remove a variety of pollutants, its potential for removing organic matter from water has not been explored adequately and it has not been used primarily for the removal of soluble organic contaminants from water. The potential of lime-soda softening to remove specific chemical contaminants was investigated under a variety of operational and chemical conditions. These contaminants included a fulvic acid extracted from peat, a fulvic acid extracted from groundwater, and a commercially available humic acid. Treatment with lime-soda softening effectively removed several humic substances from solution. Removal increased with increasing pH, with increasing amounts of precipitate, and with decreasing concentration of total organic carbon. The presence of magnesium or phosphate significantly enhanced removal, particularly when a small amount of precipitate was formed. Several soluble organic chemicals were at least partially removed from true solution by the treatment, although some were not removed to any significant extent. High residual calcium concentrations and vaterite formation resulted from soda-induced precipitation in batch systems, and total organic carbon removals were only slightly greater than those achieved with lime-induced precipitation. Calcium ion caused the precipitation of several organic substances at elevated pH in the absence of carbonate ion, indicating that precipitation is a potential removal mechanism. Calcium, carbonate, phosphate, and magnesium ions all influenced the removal of peat fulvic acid by lime-soda softening, suggesting that adsorption may be a major removal mechanism. (Carroll-FRC)
W83-00172

WEST RIVER GETS INNOVATIVE TECHNOLOGY,
New Haven Water Co., CT.
R. McHugh, and K. W. Henderson.
Water/Engineering and Management, Vol 129, No 8, p 47-48, July, 1982.

Descriptors: *Filtration, *Drinking water, *Water treatment, Automation, Potable water, Water quality, Water treatment facilities, Connecticut.

The first direct filtration plant in Connecticut was built by the New Haven Water Company near Woodridge. Fully automated, the West River plant treats water with potassium permanganate and caustic soda if necessary, coagulation (cationic polymer with or without alum) in the flash mixing, and filtration through four 600 sq ft filters. Filter backwash water is discharged to two 800,000 gal lagoons. Filtered and fluoridated water enters two 3 million gal ground level storage reservoirs prior to entering the distribution system. The plant requires only one 8-hour shift of 2 persons each day with personnel on call to answer alarms during the unmanned periods. (Cassar-FRC)
W83-00197

NEW TECHNOLOGY FOR DRINKING WATER TREATMENT,
Illinois Univ. at Urbana-Champaign. Dept. of Environmental Engineering.
S. J. Randtke.
Water/Engineering and Management, Vol 129, No 8, p 38-40, 42, 44, July, 1982. 3 Fig, 2 Tab, 8 Ref.

Descriptors: *Activated carbon, *Filtration, *Water treatment, Adsorption, Direct filtration, Organic compounds, Magnesium carbonate, Ozonation, Biological treatment, Ion exchange resins, Resins, Drinking water, Ammonia, Oxidation, Potable water.

New developments in drinking water treatment technology have been affected by cost and energy constraints, the public pressure for potable and palatable water, environmental regulations, and conservatism in engineering and regulatory fields. Examples of treatments resulting from these influences are direct filtration, activated carbon adsorption, ozone plus granular activated carbon, biologically enhanced activated carbon adsorption, ion exchange and adsorbent resins, and the magnesium carbonate process. Each process has advantages and disadvantages and is effective in treating certain impurities. Direct filtration works best with waters of low turbidity. Activated carbon removes most taste and odor problems and many synthetic organic chemicals. Ozonation prior to granular activated carbon adsorption improves taste and odor, oxidizes Fe and Mn, disinfects, improves ammonia removal by promoting growth of nitrifying bacteria, and greatly reduces formation of trihalomethanes. Biologically enhanced activated carbon adsorption extends the life of activated carbon beds and improves efficiency by removing biodegradable but nonadsorbable compounds. Synthetic resins are presently in the laboratory and pilot stage of investigation; however, they may be very useful in specialized applications. Magnesium carbonate-lime treatment reduces chemical costs and allows recovery of CaCO3 from sludge so it may be recycled or sold. (Cassar-FRC)
W83-00198

CONTROL MEASURES FOR GROUNDWATER VOCS,
Pirnie (Malcolm), Inc., White Plains, NY.
G. P. Westerhoff, and V. W. Uhl, Jr.
Water/Engineering and Management, Vol 129, No 8, p 30-33, July, 1982. 4 Fig, 7 Ref.

Descriptors: *Organic compounds, *Groundwater pollution, Water treatment, *Volatile organic compounds, Chlorinated hydrocarbons, Solvents, Wells, Adsorption, Water pollution prevention, Water pollution treatment, Water pollution sources, Water quality control, Cost analysis, Plumes, Aeration, Activated carbon.

Many options exist for prevention or treatment of volatile organic compounds (VOC) in groundwater. These compounds, typified by trichloroethylene and tetrachloroethylene, have been found in 45% of the public water systems serving over 10,000 people and 12% of smaller systems which use groundwater. Control at the source prevents contamination from reaching the water supply. This may be accomplished by eliminating the source of the VOC, blending contaminated water with cleaner water to achieve acceptable levels, controlling plume migration by pumping selected wells to waste, and installing interceptor/recovery wells to control plume migration. VOCs in a drinking water supply may be most cost-effectively treated by aeration or granular activated carbon adsorption or a combination of both. Two types of aeration equipment are available: diffused (bubbles of air passed upwards through the water) and waterfall (cascades, multiple trays, spray nozzles, or countercurrent packed columns). Each has advantages and disadvantages. The choice of a suitable process depends on the solubility of the chemical and its affinity for activated carbon. Saturated compounds are less easily adsorbed on activated carbon than unsaturated compounds. In designing a treatment system the following should be considered: on-site carbon regeneration of less than 2000 lb per day is uneconomical, several organic chemicals may be present simultaneously, and site conditions are variable. (Cassar-FRC)
W83-00199

HYDRODYNAMICS AND FOULING OF PRESSURE DRIVEN MEMBRANE DESALINATION AND WATER TREATMENT SYSTEMS,
Massachusetts Inst. of Tech., Cambridge. Dept. of Mechanical Engineering.
For primary bibliographic entry see Field 3A.
W83-00244

AN EVALUATION OF THE RECOVERY OF ADIRONDACK ACID LAKES BY CHEMICAL MANIPULATION,
Clarkson Coll. of Technology, Potsdam, NY. Dept. of Civil and Environmental Engineering.
For primary bibliographic entry see Field 5G.
W83-00245

ALGAE REMOVAL BY INDUCED AIR FLOTATION,
Louisiana Water Resources Research Inst., Baton Rouge.

For primary bibliographic entry see Field 5G.
W83-00277

WATER TREATMENT FOR SMALL PUBLIC SUPPLIES,
New Mexico State Univ., Las Cruces. Dept. of Chemical Engineering.
D. B. Wilson, and R. M. Duran.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-108175, Price codes: A06 in paper copy, A01 in microfiche. Water Resources Research Institute, Report No 141, New Mexico State University, Las Cruces, February, 1982. 93 p, 13 Fig, 45 Tab, 31 Ref, 8 Append. OWRT T-0009-NMEX(7515)(4), 14-34-0001-7515.

Descriptors: *Reverse osmosis, *Electrodialysis, *Drinking water, *Water treatment, *Water supply, Ion exchange, Engineering, Design criteria, Spectrophotometry, Estimated costs, Small watersheds, *New Mexico, Water supply development, Water supply systems, Potential water supply, Chemical precipitation, Water demand, Membrane processes, Water quality standards.

Reverse osmosis (RO) and electrodialysis (ED) were shown to be successful methods for upgrading current drinking water supplies for small New Mexico communities to meet drinking water standards. A mobile demonstration unit was operated 500-2000 hours in each of nine communities visited, using feed from the current drinking water supply. In all cases, product water from the demonstration unit (as certified by the appropriate agency) met drinking water standards. Engineering design data are presented for the evaluation of ED, RO, and ion-exchange unit operations for application in the drinking water systems. The potential for selective removal of ionized cationic contaminants by precipitation as their sulfides was also assessed (for cadmium, mercury, and zinc), using a developed stopped-flow spectrophotometry technique. Preliminary data indicated the appropriateness of sulfide precipitation under special conditions (e.g., low total dissolved solids, high concentrations of only 1-2 of the cations). Application of this technique to the removal of fluoride as calcium fluoride required a large excess of calcium for reasonable precipitation/sedimentation rates; any effect of the added calcium on drinking water quality should be considered. (Zielinski-MAXIMA)
W83-00280

BLACKHEATH WATER TREATMENT PLANT,
City Engineering Dept., Cape Town, South Africa.
J. G. Brand.
Imiesa (Johannesburg), Vol 6, No 1, p 28-29, 31, 33, December-January 1980/81.

Descriptors: *Water treatment, *Water treatment facilities, *Water supply, *Design criteria, *Reservoir storage, Wastewater facilities, Chlorination, Water demand, Water supply systems, Water quality, Water quality management, Civil engineering, Sanitary engineering, Evaluation, *South Africa, Water storage.

The Riviersonderand/Berg/Eerste Rivers water augmentation scheme, promoted by the South Africa Department of Water Affairs to exploit the Riviersonderend, brings under control five different catchments (Upper Berg, Upper Riviersonderend, Banhoek, Eerste, and Wolwekloof Rivers). The City of Cape Town's responsibilities in this scheme includes the water treatment plant, currently under construction at Blackheath for water supply of the greater Cape Town area. Details of the treatment process and plant design are presented. In the treatment process, alum, lime, and sodium aluminate are mixed with influent water; this is followed by conditioning and settling tanks (removal of floc particles), passage through two banks of 20 filter beds each with 1-meter fine sand in the bottom, addition of lime and carbon dioxide for water stabilization, addition of chlorine for sterilization, and transfer to a storage reservoir. Engineering design specifics and operation of this process (which was technologically proven at alternate installations) are delineated and illustrated. The remaining major unit of the City of Cape Town's responsibility in the scheme will be a 550 mega-liter service reservoir planned for construction near the water treatment plant. Supplies from this scheme are expected to meet urban water demands in the Western Cape until 1987-88; planning is now underway for the next augmentation project to meet water needs thereafter. (Zielinski-MAXIMA)
W83-00283

INCREASING ARCAT TEST SENSITIVITY FOR EXAMINATION OF POTABLE WATERS,
Atlantic Research Corp., Alexandria, VA.
J. D. Isbister, J. L. Alm, R. Foutch, A. DeSouza, and R. S. Wentzel.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-196163, Price codes: A06 in paper copy, A01 in microfiche. Environmental Protection Agency Project Summary EPA-600/S2-82-025, May 1982. 5 p, 1 Fig, 3 Tab. 68-03-2914.

Descriptors: *Coliforms, *Coliphages, *Water analysis, *Disinfection, *Water treatment, Bacterial analysis, Membrane filters, Potable water, Chlorine dioxide, Ozone, Fecal coliforms, Water quality.

A method for concentrating coliphages from potable waters was developed to used in conjunction with a rapid coliphage analysis technique (ARCAT) to detect 1 coliphage/100 ml of water sample. Membrane filtration with the use of positively charged filters is the concentration method of choice. Positively charged filters can be used successfully to concentrate coliphages present in potable waters at a level of 1 plaque forming unit (pfu)/100 ml of water sample using the ARCAT procedure. The ARCAT amplification technique can be used to obtain qualitative indication of the presence of coliphage when coliphage numbers are expected to be less than 5/100 ml and can be run in parallel with the ARCAT/concentration procedure. Test results are available in 6.5 hours at an approximate cost of $4.12 per test. ARCAT results can be used to estimate the number of fecal and total coliforms in the water sample or may be used independently as an indicator of water quality. Examination of the effects of physical treatment of water indicated that settling and filtration are effective means for reducing levels of coliphages and total and fecal coliforms in natural waters. Coliphages appeared to be less efficiently removed by these processes than total and fecal coliforms. Disinfection studies indicated that chlorine dioxide was effective as a viricide and bactericide. At ozone levels achieved in this study, reductions in coliphages and coliforms were not consistent. Ozone disinfection effectiveness was both concentration and exposure-time dependent. (Moore-SRC)
W83-00293

INSTRUMENTAL METHODS OF MONITORING AND CONTROL OF WATER AND WASTEWATER TREATMENT PROCESSES,
Taylor (John) and Sons, London (England).
R. Briggs.
ISA Transactions, Vol 21, No 2, p 59-73, 1982. 6 Tab, 49 Ref.

Descriptors: *Automation, *Water treatment, *Wastewater treatment, *Water distribution, United Kingdom, U.S.A., Computers, Control systems, Monitoring, Sensors, Remote sensing, Management planning, Water pollution control, Pollutant identification, Manpower.

The role of instrumentation and control for cost-effective management of water courses and water and wastewater treatment facilities is discussed. In the United Kingdom (U.K.) emphasis will probably be placed on control instrumentation used to maintain quality standards for potable waters and effluents with lower energy consumption and manpower. It is likely that the market for specialized sensors to monitor specific organics and toxic metals will increase. Monitoring of water upstream of intakes to ensure the effectiveness of wastewater treatment plants and to protect against the effects of accidental spills entering the intake will also increase. Existing sensors include those that monitor and control flow, dissolved oxygen, organic and suspended matter, hardness, and pH value. Recent sensor developments include one based on coulometry using two platinum electrodes and a pulsed differential anodic-stripping voltammeter with a hanging mercury drop electrode for monitoring metals; research into the use of polymers, phthalocyanines, and other organic films to measure volatile organics in the head space; and devices to detect oil and toxicity (especially biological techniques). Computers can be used to detect sensor failure, for example by comparing values transmitted by the sensor with previous values in the computer's memory. Instrumentation applications in the U.K., and U.S.A., Europe, and Japan are described. Two telecontrol systems for water distribution are in use in the U.K., and about 100 automated central control stations exist in the U.S.A. In water treatment, recent developments in the U.K. will probably lead to the use of feedforward control systems, whereas in the U.S.A. most installations are supervisory and devoted to monitoring local analog loops with alarms. For wastewater treatment, developments in the U.S.A. have been in the area of computer control directed toward plants serving large populations, while those in the U.K. have mainly been aimed at monitoring as a management aid. (Gish-FRC)
W83-00314

WATER SUPPLY AND TREATMENT, SECTION C-1, RAW WATER PREPARATION.
Public Works, Manual, P C2-C10, 1982.

Descriptors: *Drinking water, *Sedimentation, *Screens, *Intakes, *Suspended solids, Orifices, Chemical treatment, Chemical coagulation, Flocculation, *Water treatment, Clarification, Sedimentation basins.

The treatment of raw water for human consumption and industrial needs is discussed, and equipment for water preparation is described. Specific products are mentioned, including types of intakes and screens, coagulating chemicals, and sedimentation tanks. Coarse screens, fine screens, microstraining, and automatically operated screens are discussed for concentrating impurities in raw water. Removal of finely suspended materials is considered in a discussion of coagulating chemicals, proper handling of chemicals, and mixing and flocculation equipment. Sediment and coagulated flock can be removed using horizontal flow sedimentation tanks, upward flow tanks, and tube-type clarifiers. Sources for package plants are also listed. (Small-FRC)
W83-00335

DISINFECTION, TASTE AND ODOR CONTROL.
Public Works, Manual, p C21-C26, 1982.

Descriptors: *Drinking water, *Disinfection, *Odor control, *Taste, *Chlorination, Chemical treatment, Ammonia, Ozone, Ozonation, Mechanical equipment, Adsorption, Activated carbon, Potassium compounds, Copper sulfate, Odor-producing algae, Algal control, Water treatment, Aeration, Hydrogen sulfide.

Methods and equipment for the disinfection of drinking water and taste and odor control are reviewed. Disinfection chemical include chlorine, calcium hypochlorite, and ammonia, and water supplies can also be disinfected using ozonation. Chlorinators, which meter chlorine gas, hypochlorinators, ammoniators, chlorine evaporators, and dechlorinators are described. Taste and odor control are made possible through adsorption using substances such as activated carbon, chemical oxidation using potassium permanganate or ozone, and algae control using copper sulfate. Aeration and deaeration are used to remove taste and odor, and degasifers are used to remove entrained gases such as hydrogen sulfide. Sources are listed for most of the equipment discussed. (Small-FRC)
W83-00341

SOFTENING, IRON AND MANGANESE REMOVAL.
Public Works, Manual, p C15-C21, 1982.

Descriptors: *Drinking water, *Water softening, *Iron, *Manganese, *Fluorides, Ion exchange, Electrodialysis, Reverse osmosis, Oxidation, Fluoridation, Water treatment, Zeolite process, Chemical treatment, Mechanical equipment.

Removing mineral impurities from public water sources is discussed, including water softening and iron and manganese removal. Legislation limiting mineral concentrations is reviewed. The lime-soda process, stabilizing softened water, disposal of process sludge, zeolite softening, and ion exchangers are aspects of softening. Desalting techniques for the removal of dissolved impurities other than calcium, magnesium, iron, manganese, or fluorides include ion exchange, electrodialysis, and reverse osmosis. Iron and manganese are removed using oxidation or zeolite treatment. Fluoride adjustment methods and equipment include removal by activated alumina and addition by solution feeders. Sources of equipment and chemicals are listed for each topic discussed. (Small-FRC)
W83-00342

5G. Water Quality Control

TRADE EFFLUENT CONTROL AND THE MICROPROCESSOR,
Anglian Water Authority (England). Lincoln Sewage Div.
J. J. Sweeney.
Water & Waste Treatment, Vol 25, No 5, p 40-42, May, 1982.

Descriptors: *Data processing, *Effluent charges, *Industrial wastewater, *Wastewater management, Wastewater treatment, Computer programs, Automation, Effluent limitations, Computers, Data storage and retrieval, Microprocessors.

In recent years, Trade Effluent Officers (TEO) have been expected to assess the degree of variation in effluent quality of each discharge and be able to predict the financial effect of any variation in sampling frequency. The TEO should also maintain close contact with trade industries and with other departments in his own treatment plant. To keep accurate trade effluent accounts, a microprocessor with an associated printer is also helpful. Microprocessors can provide a detailed breakdown of the quantity and quality of trade effluent discharged to a particular sewage treatment works. To set up a microprocessor system, the computer programmer must be given as much information as possible. Accurate records should be kept of the way a program is written. The disc based system of the Lincoln Sewage Division of the Anglian Water Authority is described. Discs are sometimes stored at a different location so that information is not totally lost should an accident occur. All the water authorities could use similar trade effluent computer systems if the modified Mogden formula were implemented. If microprocessors were to be fully utilized, the TEO's time would be freed to play a more active part in the management of the treatment plant. (Geiger-FRC)
W83-00003

THE NATION'S WATER,
For primary bibliographic entry see Field 6D.
W83-00004

CORRELATION OF ROTIFER ASSOCIATIONS IN A CHAIN OF LAKES FED BY RECLAIMED SEWAGE,
Concordia Univ., Montreal (Quebec).
T. Nogrady.
Hydrobiologia, Vol 89, No 3, p 277-284, May, 1982. 3 Fig, 4 Tab, 8 Ref.

Descriptors: *Water pollution effects, *Rotifers, *Species diversity, *Reclaimed water, *Artificial lakes, *Wastewater renovation, Aquatic animals, Species composition, Population density, Lakes, Water reuse, Wastewater management, Population dynamics, *California.

As part of the Padre Dam Municipal Water District reclamation project, a preliminary study was made of the quantitative composition of the rotifer fauna of seven interconnected lakes of southern California. The lakes are fed by reclaimed sewage. The water quality increases dramatically from the first lake, which is barely able to support life, to a cluster of lakes supporting fish and varied recreational uses. This gradual improvement in water quality paralleled an increased rotifer population density in the better quality lakes, according to the Shannon index. From 24 to 28 different rotifer taxa were identified in each lake. Dominant communities were made up of Brachionids, Keratella, and Trichocerca. In the last lake, the only lake receiving reclaimed sewage from the percolation channel, the diversity and quantity of the rotifer association again declined. Use of the Bray and Curtis index of similarity and cluster analysis showed a biotic development with a maximum curve and a lake-chain evolution. (Geiger-FRC)
W83-00023

DISSOLVED ORGANIC CARBON AND UV-ABSORPTION IN A POLLUTED LOWLAND BROOK-POND SYSTEM,
Antwerp Univ., Wilrijk (Belgium).
L. Maes.
Hydrobiologia, Vol 89, No 3, p 269-276, May, 1982. 3 Fig, 4 Tab, 16 Ref.

Descriptors: *Water treatment, *Aeration, *Ponds, *Spectral analysis, *Organic carbon, Water pollution treatment, Water pollution prevention, Organic wastes, Water pollution control, Dissolved solids, Suspended solids, Absorption, Monitoring, Organic matter, *Belgium, Antwerp.

In Antwerp, Belgium a lowland brook-pond system that was polluted with organic wastes was aerated by the Phallus technique, involving a water jet vacuum pump. The brook-pond system has a difference in height between inflowing and outflowing water of about 4.3 m, and covers a stretch of 1500 m overall, in a number of successive brook-sections and ponds. The system is fed by two lowland brooklets supplying wastewater (domestic sewage). Over the course of a year the discharge strongly fluctuates, primarily due to the influence of precipitation. Usual inflow varies from 100 to 250 cu m/day, but the range has been from 10 to 500 cu m/day. The evolution of the organic carbon concentration and the UV-absorption was monitored from June 1974 to September 1976 at 12 sampling stations along the brook-pond system. Aeration caused an abrupt decrease in the organic carbon concentration in the immediate vicinity of the experimental station and a more gradual decrease at the downstream sampling sites. In general, changes in the concentrations of dissolved organic matter in natural waters are reflected in UV-absorption changes. From physico-chemical measurements such as turbidity, chemical oxygen demand and organic nitrogen, it appeared that changes brought about by aeration were more readily observed in the suspended than in the dissolved fractions. It was concluded that UV-absorption measurements serve as a simple and reliable method for determining the general trends occurring during water purification. (Geiger-FRC)
W83-00024

GUIDELINES FOR SURFACE WATER QUALITY: VOL 1: INORGANIC CHEMICAL SUBSTANCES: COPPER,
Department of the Environment, Ottawa (Ontario). Inland Waters Directorite.
A. Demayo, and M. C. Taylor.
Report, 1981. 55 p, 5 Tab, 383 Ref.

Descriptors: *Copper, *Literature reviews, *Water quality standards, *Water pollution effects, Water quality control, Toxicity, Poisons, Trace elements, Heavy metals, Aquatic life, Livestock, Water pollution control, Surface water, Runoff, Ion transport.

Information is summarized for an extensive literature survey, carried out on the toxic effects of copper (Cu) and Cu compounds or human health, aquatic life, plants, and livestock. Considering that the requirements of human metabolism are satisfied by a normal diet, that prolonged ingestion of larger Cu does may produce liver damage, and that Canada surface waters do not exceed 0.5 mg/liter of Cu, it is recommended that the Canada maximum Cu concentration in raw public water supplies should not exceed 0.5 mg/liter as total Cu. For lakes/rivers, are related to aquatic life and wildlife, the recommended Cu limit is 0.002 mg/liter total Cu, but existing levels and the effects of local water quality must be considered when setting an objective for Cu for specific water bodies. It is recommended that Cu concentration in livestock drinking water not exceed 1 mg/liter for sheep/cattle, and 5 mg/liter in all other cases. For continuous irrigation on all soils or intermittent irrigation of land having Cu-sensitive plants (e.g., vegetables), total Cu in irrigation water should not exceed 0.2 mg/liter. Recommended limits for Cu for recreational waters and industry water should be 0.5 mg/liter in both cases. Tabular data on global Cu sources to the environment, Cu emissions to the atmosphere, short-term lethal tolerance of freshwater invertebrates, and sublethal/acute toxicities of Cu to fish are included. (Zielinski-MAXIMA)
W83-00079

SOLID WASTE MANAGEMENT IN SOUTH AFRICA,
National Inst. for Water Research, Pretoria (South Africa).
W. C. Tworeck.
CSIR Technical Guide K47, 1979. 130 p, 9 Fig, 12 Tab, 64 Ref.

Descriptors: *Solid wastes, *South Africa, *Waste management, *Standards, *Landfills, Waste disposal, Environmental protection, Land disposal, Hazardous materials, Municipal wastes, Waste dumps, Solid waste disposal, Garbage dumps, Waste recovery, Recycling, Sanitary landfills, Domestic wastes.

This guide describes various processes for solid waste management, including its production, collection, composition, and disposal. Special attention is given to sanitary landfilling, still the most efficient and economic means of solid waste disposal in most cases. The location and operation of suitable landfilling sites that effectively abate potential water/air pollution assists the reclamation of otherwise unsuitable/marginal land. Three different methods of sanitary landfilling are described: trending; area filling; and progressive slope methods. Sources of toxic wastes and suitable methods for their disposal are discussed in detail. It is recommended that recovery of material from solid waste should be propagated. In addition, special reference is made to the composting of solid waste. The guide is intended to assist managers in the municipal area with problems that arise from solid waste management and disposal, particularly those who have to consider the installation of new solid waste processing equipment or disposal facilities. Special attention is given to the environmental impact of wastes on disposal sites where they will affect the environment over extended period of time. (Zielinski-MAXIMA)
W83-00090

SIMPLE CONTROL TESTS FOR OPERATORS OF SMALL WASTEWATER TREATMENT PLANTS,
National Inst. for Water Research, Pretoria (South Africa).
For primary bibliographic entry see Field 5D.
W83-00092

THE ECOLOGY OF THE MANGROVES OF SOUTH FLORIDA: A COMMUNITY PROFILE,
Virginia Univ., Charlottesville. Dept. of Environmental Sciences.
For primary bibliographic entry see Field 6G.
W83-00093

CHEMICAL SURVEILLANCE OF RIVERS,
Severn-Trent Water Authority, Birmingham (England). Directorate of Scientific Services.

For primary bibliographic entry see Field 5A.
W83-00134

NEW EPA SODIUM AND CORROSION REGULATIONS: THEIR BASIS AND IMPACTS,
Camp, Dresser, and McKee, Inc., Boston, MA.
J. C. Thompson.
Journal of the New England Water Works Association, Vol 96, No 2, p 104-108, 1982. 1 Tab, 11 Ref.

Descriptors: *Water quality standards, *Sodium, *Corrosive water, Regulations, Standards, Pipes, *Massachusetts, Water treatment, Drinking water.

The EPA promulgated amendments (August 1980) to the Interim Primary Drinking Water Regulations of the Safe Drinking Water Act which require monitoring of public water supplies for corrosivity and sodium levels. The Massachusetts Department of Environmental Quality Engineering is in the process of establishing a new sodium policy. Limiting the corrosivity and sodium levels promotes public health. Dangers of corrosive water, in addition to the unesthetic colors sometimes found, include high levels of Pb, Cd, Zn, Cu, and asbestos. Excessive Na levels are also undesirable for persons on a Na-restricted diet. EPA requires monitoring at specified intervals for Na and for corrosivity, as based on the Langelier Index. Pipe construction materials must be analyzed to detect the presence of Pb, Cu, galvanized, ferrous, and asbestos cement materials. The present Massachusetts regulations, more stringent than EPA requirements, will also require permission to use any water treatment chemicals that could increase Na levels. (Cassar-FRC)
W83-00137

WATER QUALITY IN URBAN STREAMS--WHAT WE CAN EXPECT,
North Carolina Dept. of Natural Resources and Community Development, Raleigh. Div. of Environmental Management.
For primary bibliographic entry see Field 5C.
W83-00144

EFFECTS OF MICHIGAN'S PHOSPHORUS DETERGENT BAN ON MUNICIPAL CHEMICAL COSTS,
Michigan Dept. of Natural Resources, Lansing.
J. H. Hartig, F. J. Horvath, and R. C. Waybrant.
Journal of the Water Pollution Control Federation, Vol 54, No 3, p 316-317, March, 1982. 3 Tab, 4 Ref.

Descriptors: *Phosphorus, *Municipal wastewater, *Cost analysis, Wastewater treatment, Water pollution control, Chemical treatment, Detergents, Michigan.

The effect of Michigan's ban on the sale of household laundry detergents that contain more than 0.5% by weight of elemental phosphorus on chemical costs at selected municipal wastewater treatment facilities was evaluated. An earlier study showed that the ban resulted in a reduction of the phosphorus concentration in municipal treatment plant influents and effluent. Nine municipal wastewater facilities were investigated for chemical cost savings as a result of the ban. These plants each had phosphorus removal over the study period, experienced no changes in their phosphorus removal processes, and had complete data on chemical treatment and costs. Annual chemical usage at these nine plants decreased by 12 to 49% between the year prior to the ban and the year following implementation of the ban. Annual chemical costs for these plants decreased by $113 to $42,372, with no adjustment for inflation. Cost savings associated with equipment or other operation and maintenance costs for chemical feed systems were also not included. Total chemical cost savings resulting from the phosphorus ban were computed on a wastewater volume basis for each plant having chemical phosphorus removal. This analysis indicated a total annual cost savings in Michigan of about $730,000 resulting from the ban. (Carroll-FRC)
W83-00147

MANAGEMENT AND CONTROL TECHNOLOGY FOR URBAN STORMWATER POLLUTION,
Santa Clara Univ., CA. Dept. of Civil Engineering.
E. J. Finnemore, and W. G. Lynard.
Journal of the Water Pollution Control Federation, Vol 54, No 7, p 1099-1111, July, 1982. 5 Fig, 7 Tab, 36 Ref.

Descriptors: *Storm water, *Urban runoff, *Combined sewer overflows, *Water pollution control, Runoff, Vegetation, Reviews, Erosion control, Slope stabilization, Detention reservoirs, Sedimentation, Water storage, Storage, Planning, Land use, Cost analysis, Nonstructural alteratives.

Urban storm water management practices were summarized including approaches for managing and controlling pollution from urban runoff and combined sewer overflow. Best management practices (BMP), either nonstructural or low-structural, have been gaining recognition as cost-effective solutions to these problems. Nonstructural controls include institutional measures (planning and legislation), modification of maintenance practices (street cleaning), and control of development and natural land conditions to reduce runoff and pollution. Low-structural controls use natural land features with minor modifications and small simple structures to control pollution. These may be berms, earthworks, and outlet devices. The most common low-structural control is detention storage, usually constructed near the source of runoff or pollution. Erosion control methods include soil stabilization (matting, mulching, chemicals, tackifiers, and slope support), runoff control (diversion dikes, interception trenches, pipe drops, chutes and flumes, sediment barriers, and berms), and vegetation. Combined sewer overflows are generally handled by structural measures. Storage is the most important element. In-line storage (flow restriction and regulation devices and pumping stations) is most cost-effective and flexible. Off-line storage, alone or combined with in-line storage, includes sedimentation/storage tanks or ponds, some of which also provide treatment. Integrated systems (combined sewer overflow controls, dry-weather treatment facilities, plus BMP) are even more cost-effective. This review discloses several deficiencies in storm water management information such as limited performance data especially for integrated systems, insufficient cost data base, less information on source control strategy than on combined sewer overflow strategy, and lack of monitoring data to support the claimed benefits for storm water abatement programs. (Cassar-FRC)
W83-00148

OPERATION CONTROL.
Public Works, Manual, p D57-D62, 1982.

Descriptors: *Mechanical equipment, *Flow measurement, *Wastewater facilities, *Laboratory equipment, Flowmeters, Flow rates, Gages, Sampling, Safety, Photometry, Measuring instruments.

Equipment to monitor the flow through a wastewater treatment plant as well as performance of the plant under various conditions is discussed. Flow measurements may be necessary in open channels, weirs, flumes, pipes, and manholes. Meters are also available to measure sewage-sludge digester gas, sewage temperature, rainfall, and sludge thickness. Water samplers are frequently needed by treatment facilities, as is water testing equipment. Laboratory equipment is needed to determine the chemical, physical, and biochemical parameters of treatment streams. Photometric analyzers, safety instrumentation, and supervisory instrumentation are often needed. Details are given on various types of instruments available, and the names and addresses of manufacturers are included. (Small-FRC)
W83-00155

WATER QUALITY STANDARDS AND WATER QUALITY,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
G. F. Lee, R. A. Jones, and B. W. Newbry.
Journal of the Water Pollution Control Federation, Vol 54, No 7, p 1131-1138, July, 1982. 1 Fig, 1 Tab, 16 Ref.

Descriptors: *Water quality standards, *Regulations, *Water pollution control, Hazard assessment, Standards, Water pollution effects, Fish, Aquatic life, Toxicity, Chlorine.

Water quality standards developed by the EPA as mandated in Public Law 92-500 (fishable, swimmable waters by 1983) serve as a basis for state water quality standards. Developed on the basis of chronic, lifetime bioassays or extrapolation of results on test species, these standards are worst case criteria. The authors reflect the opinion of many in the technical and management communities and in Congress, that water quality should be evaluated in terms of its desired beneficial uses. Since a variety of physical, chemical, and biological factors affect the impact of a chemical on water at different sites, water quality standards should be developed on a site-specific basis. Much of the obvious, gross water pollution was abated in the 1970's. The public appears unwilling to spend huge sums of money to produce almost imperceptible improvement in water quality. An example is provided in which it is difficult to justify spending additional money on dechlorination for questionable benefits. The hazard assessment procedure, a tiered approach, enables the user to determine at each level the need for continued assessment to refine the estimate of the degree of hazard and the acceptability of the hazard that exists for a contaminant in a system. This confines costly field work to certain critical phases and reduces the number of required water analyses. Since this paper was completed in 1979, the EPA has made 2 relevant policy changes: (1) the policy of presumptive applicability was dropped, allowing states to adopt less stringent standards after appropriate justification, and (2) states must develop standards for all parameters for which the EPA has criteria. The authors question the wisdom of this second requirement because many of the 65 contaminants on the list are exotic. (Cassar-FRC)
W83-00162

LAW,
Virginia Water Resources Center, Blacksburg.
For primary bibliographic entry see Field 6E.
W83-00165

DEVELOPING AND APPLYING INTERNATIONAL WATER QUALITY GUIDELINES,
Pan American Health Organization, Washington, DC.
V. M. Witt.
Journal of the American Water Works Association, Vol 74, No 4, p 178-181, April, 1982. 2 Tab, 3 Ref.

Descriptors: *Developing countries, *Drinking water, *Water quality standards, Water treatment, International commissions, Water supply development, Water pollution effects, Population exposure, Water quality management.

Since poor basic environmental sanitation is largely responsible for the high morbidity and mortality rates resulting from communicable diseases in developing countries, the World Health Organization (WHO) has given high priority to assisting member countries in their efforts to expand safe drinking water supplies and sanitation services. In 1977, the United Nations Water Conference declared the period 1981 to 1990 to be the International Drinking Water Supply and Sanitation Decade. Following this, WHO decided that a revision of the International Standards for Drinking Water (1971) was needed to reflect recent advances in scientific knowledge and practical experience relating to the presence of contaminants in water supplies and their effects on human health. In addition, WHO decided to prepare an internationally applicable set of Guidelines for Drinking Water Quality, which would present realistic approaches which would be applicable at the local level in developing countries. The International Standards contain information on criteria for hazardous and other noxious substances in drinking water. The standards desig-

nate the scientific relationship between the level of exposure to pollutants and the risk or magnitude of the harmful effects; define the acceptable or permissible limits of concentration to protect a defined population from undesirable effects from exposure; and set action levels, which indicate when action should be taken to improve drinking water quality. The Guidelines will contain numerical suggestions for water quality and a summary of the rationale used for establishing the recommended limits; recommended sampling frequency and techniques; brief guidelines on the application of recommended limits and action levels; criteria or detailed health justification for the proposed limits; and specific guidelines for the application of drinking water quality criteria to make them responsive to the needs and realities prevailing in developing countries. (Carroll-FRC)
W83-00167

MANPOWER NEEDS IN WASTEWATER TREATMENT AND COLLECTION SYSTEMS FOR THE YEARS 1980 TO 2000,
Southern Illinois Univ. at Edwardsville. Environmental Resources Training Center.
J. O. Bryant, Jr.
Journal of the Water Pollution Control Federation, Vol 54, No 3, p 213-228, March, 1982. 3 Fig, 16 Tab, 7 Ref.

Descriptors: *Personnel, *Wastewater treatment, *Wastewater collection, Projections, Wastewater facilities, Water pollution control, Personnel management, Surveys.

Data from a staffing survey of wastewater treatment and collection facilities in the United States and Canada have been used to project staffing and personnel needs for the period 1980 through 2000 for 34 occupations in water pollution control treatment and collection systems. The survey was conducted by the Personnel Advancement Committee of the Water Pollution Control Federation. The survey showed that between 141,000 and 163,000 persons are currently employed in publicly owned wastewater treatment and collection systems, with about 20% more persons employed in collection systems than in treatment systems. There are about 10,000 job vacancies in wastewater collection systems and about 5,400 vacancies in treatment job categories. If all proposed construction activity is completed, total employment in wastewater treatment and collection systems should increase to about 252,000 employees by the year 2000. Although most water pollution control systems do not require formal education or training in wastewater treatment operational procedures prior to initial employment, about 60% require certification for promotion to supervisory positions and about half require certification for operators. Although the current system of hiring unskilled personnel for entry level positions results in a failure on the part of system operators to understand the skills required to operate and maintain treatment facilities and in workers being underpaid, this practice is likely to continue. In spite of the fact that over 80% of treatment and collection systems have inadequate on-the-job training programs, such programs are expected to continue to be the major method used to develop water pollution control operations technology skills and knowledge. There is at present little incentive for employees to develop job knowledge and skills beyond the minimum required to maintain employment. Although persons trained in water pollution control technology will probably not have problems locating jobs in the foreseeable future, they will probably find that employers undervalue their skills. (Carroll-FRC)
W83-00180

PHOSPHATE AND WIND IN A SHALLOW LAKE,
Center for Environmental Studies, Leiden (Netherlands).
For primary bibliographic entry see Field 5B.
W83-00184

ACCURACY OF DETERMINATION OF AMMONIACAL NITROGEN IN RIVER WATERS: ANALYTICAL QUALITY CONTROL IN THE HARMONISED MONITORING SCHEME.
Water Research Centre, Marlow (England).
For primary bibliographic entry see Field 5A.
W83-00196

CONTROL MEASURES FOR GROUNDWATER VOCS,
Pirnie (Malcolm), Inc., White Plains, NY.
For primary bibliographic entry see Field 5F.
W83-00199

INTENSIVE FLOW MONITORING--COST-EFFECTIVENESS WITH A QUALITY EDGE,
Thomas (Frank A.) and Associates, Inc., Willoughby, OH.
P. N. Keefe.
Water/Engineering and Management, Vol 129, No 8, p 34, 36, 38, July, 1982. 1 Tab, 2 Ref.

Descriptors: *Flow measurement, *Monitoring, *Sewer systems, Weirs, Sewer infiltration, Infiltration, Cost analysis.

The Intensive Flow Monitoring approach to sewer system evaluation surveys produces a better quality of information than other methods such as Intensive Weiring. If this factor is included in a cost analysis, flow monitoring is more cost effective. Cost of two monitoring regimes are compared for a 1 million ft system with 60% already eliminated by gross flow monitoring during infiltration/inflow: (1) intensive monitoring of 4000 ft minisystems, and (2) two-stage weiring program followed by intensive weiring on a manhole-to-manhole basis, depending on night flow isolation to eliminate areas from further study. Total costs are $409,250 for alternative (1) and $512,375 for alternative (2) and are broken down into 9 tasks: manhole investigation, intensive flow metering, gross flow isolation, line by line flow isolation, smoke testing, dye water testing, interim report (25% of field work), TV cleaning, and final report. (Cassar-FRC)
W83-00200

THE PLIGHT OF AMERICAN CITIZENS INJURED BY TRANSBOUNDARY RIVER POLLUTION,
For primary bibliographic entry see Field 6E.
W83-00209

THE CLEAN WATER ACT'S SECTION 404 PERMIT PROGRAM ENTERS ITS ADOLESCENCE: AN INSTITUTIONAL AND PROGRAMMATIC PERSPECTIVE,
Lewis and Clark Law School, Portland, OR.
M. C. Blumm.
Ecology Law Quarterly, Vol 8, No 3, p 409-472, 1980. 333 Ref.

Descriptors: *Water pollution prevention, *Permits, *Dredging, Water law, Wetlands, Clean Water Act, State jurisdiction, Federal jurisdiction, Legislation, Water quality management, Solid waste disposal, Fill permits, Law enforcement, Legal aspects, Fish, Wildlife, Dams, Water pollution sources, Land use, Water allocation, Streamflow, Runoff, Interagency cooperation.

Section 404 of the Clean Water Act regulates the addition of solid materials, such as dredged or fill material, into water bodies. It prohibits discharge into sensitive aquatic ecosystems and requires mitigating management practices for the allowed discharges. This paper discusses the history of the program since its creation in 1972; its scope and exemptions; the permit process; relations between the Corps of Engineers, EPA, and other agencies; the overlaps and gaps between the National Pollution Discharge Elimination System and 404; state 404 and 208 (b) (4) which concerns control of minor discharges of dredged material through best management practices; and integrating the 404 program with state land and water use control programs. Since Section 404 regulates many types of activities, several federal agencies are involved and all must effectively cooperate. State and local groups must handle the one-time discharges related to land use practices. EPA should become more prominent as the lead 404 agency by promulgating guidelines and assuming control over programs outside 404 that help attain its goals. The Corps of Engineers must promote enforcement of 404. Uniform standards are needed for issuing permits and monitoring activities and revising regulations involving wetlands. The Fish and Wildlife Service and National Marine Fisheries Service should aggressively enforce their mandates. States can require compliance with water quality and coastal zone certification requirements, actively implement state 404 and 208(b) (4) programs, and coordinate land and water use planning activities. Congress's role is providing funds for implementation of Section 404 and aid in turning over permit authority to the states. The public can call attention to weak links in the program by entering suits and by monitoring results of court decisions. (Cassar-FRC)
W83-00210

LAKE RESTORATION TECHNOLOGY TRANSFER ASSESSMENT,
Pennsylvania State Univ., University Park.
M. H. Daschbach, E. M. Roe, and W. E. Sharpe.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-108258, Price codes: A04 in paper copy, A01 in microfiche. Completion Report, June, 1982. 56 p, 4 Tab, 2 Append. OWRT C-00192-T (0496)(1).

Descriptors: *Technology transfer, *Lake restoration, *Eutrophic lakes, *Acid rain, Evaluation, Technology, Rehabilitation, Destratification, Environmental policy, Environmental protection, Eutrophication, Oligotrophic lakes, Aquatic productivity, Public participation, Acidic water, Air pollution.

Based upon a review of the eutrophication problem and its impact on lake restoration (LR) programs, treatment of the relatively new problem of acid deposition and its impact on LR activities, consideration of the LR programs of the Environmental Protection Agency and several States, and a review of individual LR technology transfer publications, it is recommended that new LR technology transfer programs be given a low priority until more new information is available on the restoration of acidified lakes. Both primary and secondary users of LR research, technology transfer documents, and public awareness documents were considered in this assessment. Primary users included the general public and recreationists, lakeshore property owners, lake/homeowner associations, lake/sanitary districts, and research and environmental organizations; secondary users included State/County/local officials who administer/manage water-related regulations/activities. If an LR program is funded, it should be designed to produce a new public awareness report updating current state-of-the-art on LR programs, or it should fund workshop(s) for primary/secondary users of LR information to update these groups on LR techniques, financial assistance sources, and programs elsewhere in the country. An OWRT summary report of research on acid deposition in the Northeast U.S. is recommended. (Zielinski-MAXIMA)
W83-00215

A COOPERATIVE WATER RESOURCE TECHNOLOGY TRANSFER PROGRAM,
Michigan State Univ., East Lansing. Inst. of Water Research.
For primary bibliographic entry see Field 6B.
W83-00216

THE ROLE OF HYDROLOGIC VARIABILITY IN COMPLYING WITH REGULATORY ENFORCEMENT STANDARDS FOR THE REHABILITATION OF SURFACE-MINED COAL LANDS,
Arizona Univ. Tucson. Dept. of Hydrology and Water Resources.
For primary bibliographic entry see Field 6G.
W83-00223

REEVALUATION OF THE EFFECTS OF DEICING SALT RUNOFF ON A SMALL URBAN LAKE,

Michigan Univ., East Lansing. Dept. of Zoology.
For primary bibliographic entry see Field 5C.
W83-00227

NITRATE CONTAMINATION OF GROUNDWATER ON THE OLD MISSION PENINSULA: CONTRIBUTION OF LAND RESHAPING AND SEPTIC DRAINFIELDS,
Michigan State Univ., East Lansing. Dept. of Crop and Soil Science.
For primary bibliographic entry see Field 5B.
W83-00228

AN EVALUATION OF THE RECOVERY OF ADIRONDACK ACID LAKES BY CHEMICAL MANIPULATION,
Clarkson Coll. of Technology, Potsdam, NY. Dept. of Civil and Environmental Engineering.
J. V. DePinto, and J. K. Edzwald.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-108498, Price codes: A07 in paper copy, A01 in microfiche. Completion Report, June 1982. 127 p, 36 Fig, 29 Tab, 58 Ref, 3 Append. OWRT B-095-NY(1), 14-34-0001-9153.

Descriptors: *Acidic water, *Mountain lakes, *Lake restoration, *Eutrophic lakes, *Neutralization, Acid rain, Acidity, Air pollution effects, Water pollution effects, *Adirondacks, Rainfall, Lakes, Ecosystems, Chemical treatment, Limestone.

In order to develop alternative remedial methods for recovery of Adirondack acid lakes believed due to acid rain, a study was conducted on chemical manipulation methods for their neutralization. This study specifically addressed an evaluation of materials (calcium hydroxide and carbonate, agricultural limestone, fly ash, water treatment plant softening sludge, cement plant by-pass dust) for their neutralizing effectiveness and for establishing a neutral pH buffer system, and an evaluation of the effect of various lake recovery materials on algal growth. Laboratory continuous-flow microcosins were used as models to assess acid lake recovery. These models were filled with actual acid lake water over a layer of lake sediments, subjected to a given chemical treatment, and continuously fed water of selected quality (e.g., acid rain). A simulation of sediment-water-air kinetic interactions on a treated acid lake was obtained by careful monitoring of the microsin chemical response. Agricultural limestone was determined to be the most appropriate material for acid lake recovery treatment based on its neutralizing properties, assessment of its potential impact on biota, its availability, and its relative cost: The results of this laboratory study suggest that full-scale recovery of an Adirondack acid lake is technically feasible. It is, however, recommended that an acid lake recovery field demonstration project be undertaken. (Zielinski-MAXIMA)
W83-00245

A CURRICULUM FOR WATER SUPPLY AND WASTEWATER OPERATION, MAINTENANCE AND MANAGEMENT,
District of Columbia Univ., Washington. Water Resources Research Center.
M. H. Watt.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-108514, Price codes: A05 in paper copy, A01 in microfiche. DC WRRC Report No 23, April 1982. 83 p, 3 Append. OWRT A-999-DC(2), 14-34-0001-0109.

Descriptors: *Education, *Wastewater management, *Water analysis, *Water pollution, *Technology transfer, *Water supply, Wastewater pollution, Wastewater disposal, Wastewater treatment, Water quality, Water quality control, Water quality standards, Water pollution treatment, Pollutant identification, Technology, *District of Columbia.

A curriculum was developed for water supply and wastewater operation/maintenance/management, and is presented in two parts: (1) key water quality courses; (2) academic information to support the water resources courses. The description of the water quality courses includes updates and revisions; the courses separately address the chemical analysis of water, properties of fresh water, water quality management, wastewater technology, and hydrology. Academic support information provided covers an inventory of laboratory equipment, lists of reference texts and audio-visual material useful to water resources training, and a survey of employment opportunities for water treatment plant operators in the metropolitan Washington, DC area. The survey revealed good employment opportunities for these operators. Specialized courses are also discussed: waterborne disease control for public health workers, wastewater treatment plant operators training program (basic and intermediate courses), and environmental protection (homestudy course for professional health workers). The results of this effort serve to revitalize a two-year water quality academic curriculum. (Zielinski-MAXIMA)
W83-00247

WASTEWATER MANAGEMENT PROBLEMS IN RURAL COMMUNITIES,
Wisconsin Univ.-Milwaukee. Dept. of Civil Engineering.
J. Y. C. Huang.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-108530, Price codes: A03 in paper copy, A01 in microfiche. Water Resources Center University of Wisconsin, Technical Report WIS WRC 82-02, Milwaukee, 1982. 22 p, 8 Tab, 13 Ref, 2 Append. OWRT A-087-WIS(1), 14-34-0001-0153/1153.

Descriptors: *Wastewater management, *Wastewater treatment, *Rural areas, *Institutional constraints, *Statistical analysis, Wastewater disposal, Wastewater, Management planning, Planning, Septic tanks, Disposal wells, Storage tanks, Permits, Legal aspects, Fill permits, Water tanks, Septic wastewater, Correlation analysis.

The knowledge, experience, and attitudes of wastewater treatment on-site disposal systems users were examined in order to identify possible prob lems confronting institutional management of on-site systems in Wisconsin. These systems are individually owned and are scattered over relatively large areas. The major source of homeowner service experience is from septic tank pumping firms and plumbers; about 82% of the septic tank owners interviewed were satisfied with the performance of their units (due to low main tenance costs/requirements, and low taxes associated with the units). Homeowners with holding tanks, however, were dissatisfied with their systems (due to inconvenience and cost of frequent pumping requirements). Applying chi-square statistical analysis, eight significant correlations between pertinent variables were established. Management difficulties and measures f for mitigating problems were identified, providing information needed to improve homeowner on-site disposal systems. The use of rural permit fees and other service fees were found to vary considerably among counties; the annual budget and staffing among counties also varied. On-site disposal system type and quantity information was only furnished by 50% of the counti es responding; of these, only 50% could provide information on the estimated percentage of system failures. (Zielinski-MAXIMA)
W83-00249

NON-POINT POLLUTION CONTROL FOR RANGELAND WINTERING, LIVESTOCK OPERATIONS (GROUND COVER),
Idaho Univ., Moscow. Coll. of Engineering.
J. E. Dixon, A. J. Lingg, D. V. Naylor, D. D. Hinman, and G. R. Stephenson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-108563, Price codes: A03 in paper copy, A01 in microfiche. Idaho Water and Energy Resources Research Institute, Completion Report, Idaho University, Moscow, June, 1982. 31 p, 2 Fig, 14 Tab, 4 Ref, 1 Append. OWRT A-064-IDA(1), 14-34-0001-0114.

Descriptors: *Nonpoint pollution sources, *Pollution load, *Livestock, *Stream pollution, *Irrigation effects, Cattle, Grasses, Alfalfa, Streams, Range grasses, Rocky Mountains, Stochastic process, Runoff, Analysis of variance, Mathematical studies, Water analysis, Pollutant identification.

An investigation was made of stream-side cattle winter holding areas as potential sources of nonpoint-water pollution. Mass balance calculations were made for each of various measured constituents, based on irrigation inflow, runoff, and constituent concentrations. The results of these calculations quantify the pollutant loss from land wintering cattle. An analysis of variance showed no significant difference between the ground cover (hay crop) treatment means for any constituent. There was, however, a trend toward better pollutant retention with alfalfa and fescue mixture. Other grasses used with alfalfa were brome and orchard grass. The test plots were irrigated twice each year. The effect of the first versus the second irrigation was also analyzed, but no significant difference in pollutant retention was noted. Stream water samples were analyzed for ammonia, nitrate, total nitrogen and phosphorus, orthophosphate, sodium, potassium, calcium, magnesium, and chloride. Other determinations made included biological and chemical oxygen demands, dissolved oxygen, total organic carbon, suspended solids, and bacterial counts for fecal coliforms and streptococci, and for total coliforms. The data should be limited to situations involving runoff from irrigation water. It was concluded that the amount of pollutant loss to streams through irrigation return flow from land wintering cattle seems quite small. (Zielinski-MAXIMA)
W83-00252

THE LAUREL RUN ACID MINE DRAINAGE RENOVATION DEMONSTRATION FACILITY: AN EVALUATION,
Pennsylvania State Univ., University Park. Coll. of Agriculture.
W. E. Sharpe, M. A. Vanagel, and L. S. Sherwin.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-108621, Price codes: A04 in paper copy, A01 in microfiche. Institute for Research on Land and Water Resources, Completion Report, Pennsylvania State University, University Park, April 1982. 59 p, 19 Fig, 3 Tab, 2 Ref, 5 Append. OWRT A-057-PA(1), 14-34-0001-1140.

Descriptors: *Acid mine drainage, *Wastewater renovation, *Groundwater pollution, *Wastewater facilities, Mine drainage, Water quality, Irrigation, Wastewater treatment, Feasibility studies, Forests, Hardwood, Acidic water, Acidic soils, Soil water, Water treatment facilities.

An acid mine drainage treatment d emonstration facility was constructed to treat discharges from a small drift coal mine. Acid drainage was stored in a small impoundment, and used to irrigate a limed 0.23 hectare natural hardwood forest plot at 11.4 cm/week. Appreciable iron and sulfate removed and a decrease in specific conductance occurred in the storage pond. Gravity flow irrigation of the plot further improved mine discharge water quality, but pH improvement was minimal and sulfate and aluminum levels remained high in shallow groundwater samples taken just downslope of the irrigated area. The success of this demonstration facility was limited by the acidic poorly-drained soils used for irrigation. Plot tree mortality increased during the demonstration study. Tree presence made renovation more difficult and prevented soil incorporation of applied lime. Water quality of the area was slightly better while the treatment system was in operation. It is concluded that soil renovation of acid mine drainage is a promising low-cost treatment process that requires further field testing under more favorable soil conditions. The application rates used should be decreased proportionally to increased acid mine drainage strength. (Zielinski-MAXIMA)
W83-00258

NITRATE MOVEMENT AND DENITRIFICATION DEFINED RELATIVE TO BROMIDE TRACER IN TILE-DRAINED LAND,
Iowa State Water Resources Research Inst., Ames.
For primary bibliographic entry see Field 5B.
W83-00264

THE EFFECTS OF EXCESSIVE NITROGEN AND PHOSPHORUS IN SURFACE WATERS OF A PRAIRIE MARSH,
Iowa State Univ., Ames. Dept. of Botany.
C. B. Davis, and R. K. Neely.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-108050, Price codes: A07 in paper copy, A01 in microfiche. Report ISWRRI-125, Iowa State Water Resources Research Institute, Iowa State University, Ames, July 1982. 129 p, 22 Fig, 8 Tab, 47 Ref, 3 Append. OWRT A-080-IA(1).

Descriptors: *Nitrogen, *Phosphorus, *Marshes, *Surface water, *Wastewater renovation, Water quality, Wetlands, Marsh management, Wastewater disposal, Interstitial water, Fertilization, Experimental design, Nitrates, Plant growth, Phosphates, Ammonium.

Use of natural wetlands as wastewater renovation sites requires knowledge of short- and long-term effects of nutrient enrichment on the ecosystem. Research was carried out to assess the impact of nitrogen (N) and phosphorus (P) enriched marsh waters on oevels of N and P in interstitial water, and on emergent plant production and on decomposition. Ammonium nitrate and diammonium phosphate were applied to surface water of an Iowa praire marsh (Eagle Lake) in 1979 and 1980. Application in 1979 caused increases of ammonium-N (AN), nitrate-N, and phosphate-P (PP) in 15-cm interstitial water of 144, 291, and 47%, respectively. Fertilization in 1980 caused increases in AN, PP, and the non-PP fraction of total P of 189, 60, and 50%, respectively, at the same depth. Typha glanca (TG) and Sparganium euryearphum (SE) responded with increased N levels in shoots (30-34% for SE; 7-15% of TG) and root-rhizomes (SE, 25%;, 38%); and increased 1980 shoot density (SE, 20%; TG, 30%) and shoot production (SE, 86%; TG, 36%). Root-rhizome production was not altered, nor was the rate of SE or TG shoot and root-rhizome decomposition. However, over 505 days, N and P levels increased in above-ground tissues of both species with fertilization, and root-rhizome litter consistently lost N under unfertilized and fertilized conditions (24-54% for the two species). The results suggest decomposing below-ground litter is a continuous source of N under both fertilized and unfertilized conditions. (Zielinski-MAXIMA)
W83-00266

ALGAE REMOVAL BY INDUCED AIR FLOTATION,
Louisiana Water Resources Research Inst., Baton Rouge.
M. E. Tittlebaum, and S. Holtman.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-108142, Price codes: A03 in paper copy, A01 in microfiche. Completion Report, May 1982. 39 p, 4 Fig, 6 Tab, 30 Ref. OWRT A-053-LA(1), 14-34-0001-1120.

Descriptors: *Algal control, *Aquatic plants, *Flotation, *Foaming, *Surfactants, Algal growth, Amphibious plants, Aquatic weeds, Floating plants, Aerosols, Water treatment, Prototype tests, Testing procedures, Flocculation, Chemical coagulation, Dispersants, Water quality, Water quality control, Resins, Cation exchange.

Investigation was made of the feasibility of induced air flotation (IAF) as a method of removing free-floating algae from water. Bench scale tests were carried out to determine removal efficiency, run times, chemical additive concentrations, and the effects of other parameters on the process. Different organic polyelectrolytes were screened and tested as suitable additives. Significant algae removal was obtained with two medium molecular weight commercial polyelectrolytes: (1), a cationic flocculent consisting of a quatermary ammonium salt; (2) a cationic surfactant consisting of a tertiary amine conjugate acid. The former additive removed up to 92% algae when used as the IAF additive at 3 mg/liter at pH 10 for 2 minutes; the latter removed up to 80% for 2 minutes, and produced more desirable foam characteristics for removal from a flotation vessel than the former additive. A larger part of the algal floc produced in tests with the flocculant adhered to the sides of the vessel and to the air injection tube. The surfactant produced a large foam appearing as single algae cells or small algal coagules attached to the bubbles which could be easily removed. (Zielinski-MAXIMA)
W83-00277

WATER QUALITY SIMULATION OF WAHIAWA RESERVOIR, O'AHU, HAWAII,
Hawaii Univ., Honolulu. Water Resources Research Center.
S. F. Moore, G. S. Lowry, G. P. Young, and R. H. F. Young.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-108183, Price codes: A05 in paper copy, A01 in microfiche. Technical Report No 138, September, 1981. 76 p, 15 Fig, 4 Tab, 17 Ref, 5 Append. OWRT A-085-HI(2), 14-34-0001-0113/1113.

Descriptors: *Computer models, *Hawaii, *Simulation analysis, *Water quality management, *Aeration, *Water supply, *Reservoir operation, Model studies, Model testing, Mathematical models, Mathematical studies, Reservoirs, Water quality, Stochastic hydrology, Stochastic process, Prediction, Management planning, Water quality, Multipurpose reservoirs, Water management, Water pollution control, *Wahiawa reservoir, Oahu.

A computer simulation model of water quantity and quality in Wahiawa Reservoir was developed and applied. The model represents the reservoir as a dynamic one-dimensional (vertical) system, with emphasis placed on representation of vertical and temporal changes in water level, water temperature, and dissolved oxygen. A novel model feature is the inclusion of artificial aeration effects. Statistically-valid comparisons between simulated and observed water quality data over a one-year period were used for model calibration; however, this calibration afforded a low predictive accuracy (especially for temperature) for the model. Despite this, the general reservoir response behavior was well represented by the model. The model was used to evaluate alternate water quality management strategies. Use of the model to predict effects of the strategies showed that anaerobic conditions depend on oxygen-demanding sediments and high algal productivity in surface waters. Artificial aeration appeared as the most effective water quality management strategy. Simulated aeration during critical low-flow conditions caused full mixing of the aerated layer and maintenance of well-oxygenated water. (Zielinski-MAXIMA)
W83-00281

BACTERIOPLANKTON AFFECTED BY PHOSPHORUS PRECIPITATION TREATMENT IN A POLYTROPHIC LAKE,
Bayerisches Landesamt fuer Wasserwirtschaft, Munchen (Germany, F.R.).
C. Steinberg, and P. Niesslbeck.
Zeitschrift fur Wasser und Abwasser Forschung, Vol 14, No 2, p 43-46, 1981. 6 Fig, 18 Ref.

Descriptors: *Bacteria, *Plankton, *Phosphorus removal, *Lakes, Aluminum chloride, Chemical precipitation, Carbon dioxide, Absorption, Chlorophyll A, Algae, Phosphorus, Biomass, Aquatic productivity, *West Germany, Carbon dioxide dark fixation, Seasonal variation, Phytoplankton, Fischkaltersee.

The bacterioplankton population of the Fischkaltersee, a lake in Upper Bavaria (Federal Republic of Germany) was monitored to assess the effects of artificial phosphorus precipitation using aluminum chloride. Direct counts of the bacterioplankton, selected plate counts, bacteriochlorophyll a readings, and C02-dark uptake measurements were taken. After precipitation treatment, bacterial densities (direct count) decreased from 9.5 x 109 to 5.5 x 109 bacteria per sq cm. This partial breakdown of population did not exceed levels measured after a natural breakdown 4 months previously. One week after aluminum input, bacterial density had returned to its former level, and this was accompaned by a recovery of phytoplankton. Biological transport of phosphorus by the predominant alga, Oscillatoria redekei, was assumed to be the cause of rapid phosphorus replenishment in the productive layers. Changes found in saprophytic bacteria supported these results. Plotting direct counts against the sum of plate counts (Razumov quotient) resulted in great variations, and the slight shift toward plate count bacteria after aluminum treatment did not exceed the natural range. Biocenosis structure proved to be stable. Aluminum treatment decreased the bacterial biomass from 13 to 10 micrograms per liter. Microbial activity represented by C02-dark fixation exibited damage after treatment, declining greatly. The reduction may have been due partly to coprecipitation of microbial substrates with aluminum, though the reduction did not parallel readings for dissolved organics. Low winter temperatures at the time of treatment may also have played a role. (Gish-FRC)
W83-00315

WATER QUALITY CRITERIA AND EFFLUENT REQUIREMENTS IN BROWARD COUNTY, FLORIDA,
Montgomery (James M.), Inc., Pasadena, CA.
G. P. Treweek, and R. J. TeKippe.
Journal of the Water Pollution Control Federation, Vol 54, No 3, p 298-308, March, 1982. 15 Fig, 4 Tab, 2 Ref.

Descriptors: *Ocean dumping, *Water quality control, *Wastewater treatment, Wastewater facilities, Water quality standards, Data interpretation, Management planning, Regional planning, Broward County, *Florida.

Two engineering techniques were applied in Broward County, Florida, to determine whether discharge of treated secondary effluent into ambient waterways could be continued and, if not, how this effluent could be discharged into the Atlantic Ocean while meeting stringent 500 to 1 initial dilution requirements. Water quality data with respect to time and distance along the inland canals, which currently receive the wastewater discharges, were displayed topographically, allowing the engineer to rapidly assess the factors which most significantly affect the canal water quality without incurring high computer modelling costs. Recent research into the effects of ocean current on the extent of initial dilution of wastewater plumes was then utilized in evaluating options for ocean disposal. The water quality topographs showed that existing water quality standards could not be met even if current wastewater facilities incorporated tertiary treatment prior to discharge to the inland canals. A decision was made to construct three large regional wastewater treatment facilities at the coast with discharge through ocean outfalls and diffusers into the Atlantic Ocean. Although the existing temperature stratification does not permit the use of a single-plume outfall structure, use of a 2,000-foot diffuser structure oriented to take advantage of the offshore currents will permit the minimum dilution standard to be met at least 90% of the time. (Carroll-FRC)
W83-00320

USE OF THE WATER-SALT BALANCE METHOD FOR CALCULATING THE DESALINATION REGIME OF A LARGE WATER BODY,
E. S. Zasukhina, and V. S. Zasukhin.
Water Resources, Vol 8, No 4, p 373-377, July/August, 1981. 3 Fig, 2 Ref. Translated from Vodnye Resursy, No 4, p 71-76, July/August, 1981.

Descriptors: *Desalination, *Lakes, *Salt balance, Rivers, Canals, Lake Tharthar, Tigris River, Euphrates River, Flow control, Saline lakes, Model studies, Mixing, Water management, Water quality control.

Equations for water and salt balance are used to describe the desalination of a large water body by passing weakly mineralized water through it. For example, water from a river flows into a water body (lake) via a canal, mixes with saline lake water, and returns to the river further downstream via a second canal. A sample solution is given for Lake Tharthar, which communicates with the

Tigris and Euphrates Rivers. The lake contains 150 million tons of salts dissolved in 62.2 cu km of water, or 2490 mg salt per liter. The maximum capacities of the 2 canals are 600 cu m per sec in the Tharthar-Tigris and 500 cu m per sec in the Tharthar-Euphrates. The value for maximum allowable salt concentration in the downstream section of the river is 800 mg per liter. Calculations show that desalination of the lake to the desired 800 mg per liter level can be accomplished by 1987 using a two-canal system and by 1994 using only the Tharthar-Euphrates canal. (Cassar-FRC)
W83-00322

POTENTIAL APPLICATIONS OF WATER HYACINTH FOR WATER, AIR RECYCLING IN CLOSED SYSTEMS,
Maryland Eastern Shore Univ., Princess Anne. Dept. of Natural Science.
G. Gupta.
Water, Air, and Soil Pollution, Vol 17, No 2, p 199-205, 1982. 34 Ref.

Descriptors: *Water hyacinth, *Wastewater renovation, *Closed systems, Evapotranspiration, Water reuse, Aquatic plants, Wastewater treatment, Ecosystems.

The water hyacinth is one potential biological component of closed ecological life support systems being investigated for use in manned space missions. These closed systems may use higher plants and algae both for recycling water and air and for regeneration of food. Aquatic vascular plants, including water hyacinth and duckweed, have been successfully used in the treatment of municipal, agricultural, chemical, and industrial wastewaters. The water hyacinth has been very effective in removing algae, fecal coliforms, suspended particles, trace toxic metals, pesticide residues, organics, heavy metals, and many other dissolved impurities from wastewater used for plant culture. Water hyacinth loses a substantial amount of water through evapotranspiration, with some studies reporting the recovery of as much as 40% of the wastewater as pure water through evapotranspiration by water hyacinth growing on the wastewater. Water hyacinth absorbs carbon dioxide from both air and water and generates oxygen through photosynthesis. Water hyacinth, when grown over wastewater in a controlled environment/closed system, can efficiently clean up the wastewaters, provide fresh water, and possibly clean up the air by removing carbon dioxide and releasing oxygen. In addition, this aquatic plant may be used as feed for livestock and other animals, as a protein source for humans, as a source of methane, as fertilizer and compost, and for other miscellaneous purposes. (Carroll-FRC)
W83-00324

6. WATER RESOURCES PLANNING

6A. Techniques Of Planning

POLICY OBJECTIVES AND INFORMATION SYSTEM FOR IRRIGATION PROJECTS-INDIA,
Center for Development Research, Hyderabad (India).
P. K. Rao.
Water Supply and Management, Vol 6, No 3, p 243-259, 1982. 1 Fig, 1 Tab, 10 Ref.

Descriptors: *Data transmission, *Irrigation practices, *Policy making, *Management planning, Data storage and retrieval, Hydrologic data collections, Irrigation requirements, Irrigation efficiency, Water supply development, Water management, Planning, *India.

The value of a good information system both in general and specifically in the management of efficient irrigation systems in India is reviewed. A lack of clear objectives in the planning and management of water resources often leads to the evolution of a poor information system. The efficient use of water resources alone does not constitute a well-defined objective, but is often mistaken for one in irrigation management. The role and limitations of water use efficiency criteria set forth by the International Commission on Irrigation and Drainage are outlined and their associated information requirements are discussed. The Draft Water Management Manual of Andhra Pradesh is briefly reviewed to illustrate the operation of a State Irrigation Department in terms of reporting systems and data transmission. Control of irrigation in a Warabandi (water rotation) system is discussed. To make use of information for irrigation management, adequate water distribution system and measuring instruments are required. (Geiger-FRC)
W83-00011

THE PROBABILITY DISTRIBUTION OF WATER INPUTS AND THE ECONOMIC BENEFITS OF SUPPLEMENTARY IRRIGATION,
International Inst. for Applied Systems Analysis, Laxenburg (Austria).
R. J. Anderson, Jr.
Water Supply and Management, Vol 6, No 3, p 281-291, 1982. 5 Tab, 3 Ref.

Descriptors: *Mathematical models, *Statistical methods, *Economic aspects, *Irrigation efficiency, *Planning, Water supply development, Model studies, Mathematical studies, Crop production, Irrigation practices, Irrigation requirements, Capital.

The relationship between changes in the probability distribution of water inputs to crop production induced by supplementary irrigation and economic benefits of supplementary irrigation determined by increased expected farm income is examined. The contribution of supplementary irrigation to expected farm income depends partly upon its effect on the mean of the water input distribution and partly upon its effect on the variance of the water input distribution. The reduced variability of the distribution of water input allows economic benefits even when the effect of supplementary irrigation on the mean of the water input distribution is negligible. This conclusion does not depend upon any special assumptions about the farmer's attitude toward risk. The present analysis may also be used to study the economic effects of climate change. (Geiger-FRC)
W83-00016

RESERVOIR MANAGEMENT IN POTOMAC RIVER BASIN,
Washington Univ., Seattle. Dept. of Civil Engineering.
R. N. Palmer, J. A. Smith, J. L. Cohon, and C. S. ReVelle.
Journal of the Water Resources Planning and Management Division, Proceedings of the American Society of Civil Engineers, Vol 108, No WR1, p 47-66, March, 1982. 6 Fig, 2 Tab, 47 Ref.

Descriptors: *Metropolitan water management, *Reservoir operation, *Mathematical studies, Reservoir yield, Simulation analysis, Linear programming, Water supply, Management planning, River basins, *District of Columbia, *Potomac River, Patuxent River, Water resources development.

Techniques for determining the yield of multireservoir water supply systems have been developed and applied to the system that serves the Washington, DC, metropolitan area. This area is served by three agencies which obtain water from the Potomac and Patuxent River basins and from the five reservoirs which lie in these basins. A simulation technique which was extended to include multireservoir systems operated in conjunction with free flowing rivers was used to determine the yield of each reservoir in the system. Linear programming models which incorporated projected water demands and limitations on the distribution and treatment capacities of the agencies supplying water to the area were used to perform a multiobjective analysis of conflicting water use objectives in the region. Analyses using the simulation technique and the linear programming models demonstrated that a significant degree of synergism exists within the regional water supply system and that proper joint management of the water resources can result in an increase in yield equivalent to the capacity of a large reservoir. Current treatment and withdrawal limitations decrease the historic yield of the system by about 100 million gallons per day. For several formulations, the results obtained using the simulation models were equivalent to those obtained from linear programming models. (Carroll-FRC)
W83-00203

RURAL WATER SUPPLY SYSTEMS: IMPROVED PLANNING STRATEGIES THROUGH SYSTEMS ANALYSIS,
Iowa State Univ., Ames. Dept. of Civil Engineering.
T. A. Austin, R. S. Schulz, and R. B. Robinson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-108456, Price codes: A05 in paper copy, A01 in microfiche. Iowa State Water Resources Research Institute Report ISWRRI 76, Iowa State University, Ames, June 1982. 89 p, 27 Fig, 7 Tab, 22 Ref. OWRT A-048-IA(7), 14-31-001-5105.

Descriptors: *Iowa, *Water conveyance, *Rural areas, *Systems analysis, *Optimum development plans, *Peak demand, *Livestock, Dynamic programming, Input-output analysis, Optimization, Systems engineering, Design criteria, Water supply, Potential water supply, Water supply development, Planning, Water use.

Research was carried out to assess the state-of-the-art of planning strategies currently used by institutions and consultants in planning rural water supply systems, and to explore systems analysis techniques for improving the planning/design/operation/management of such systems. Peak use periods with large livestock populations were larger than those seen in high density residential areas, occurring between 7-11 AM and 4:30-8:30 PM. Nomagraphs from literature data indicating daily livestock water consumption appear to provide reasonable predictions of livestock water needs based on animal weight and average ambient temperature. Peaking factors seen for two test sections were higher than would be used for design of water systems for residential/industrial/commercial water use. Restricted to only residential water system design criteria, the peaking factors fall within acceptable ranges. The currently used plant capacity design value (60 gallons/capita/day) is in line with observed per capita use if a small reserve is considered for future growth. A method was developed and demonstrated for optimizing a branching rural water distribution system, considering: pipe diameter, pipe pressure rating/class, pressure regulating valve location and setting, and initial head. It is most appropriate to gravity flow areas from a water tower. Any dead and pipe network can be analyzed with this method if the head loss/unit pipe length is obtainable from flow and pipe diameter. (Zielinski-MAXIMA)
W83-00241

EFFECTIVE GRAPHICAL DISPLAY OF WATER RESOURCE PLANNING INFORMATION FOR DECISION MAKERS, VOLUME I,
Gates (W. E.) and Associates, Inc., Batavia, OH.
For primary bibliographic entry see Field 10D.
W83-00273

EFFECTIVE GRAPHICAL DISPLAY OF WATER RESOURCES PLANNING INFORMATION FOR DECISION MAKERS, VOLUME II,
Gates (W. E.) and Associates, Inc., Batavia, OH.
For primary bibliographic entry see Field 10D.
W83-00274

6B. Evaluation Process

LUMP SUM TAX LOSS REIMBURSEMENT UNDER THE THAMES RIVER FLOOD CONTROL COMPACT,
Massachusetts Univ., Amherst. Dept. of Food and Resource Economics.
D. A. Storey, D. A. Lass, J. Diamond, and B. E. Lindsay.

Water Resources Bulletin, Vol 18, No 3, p 409-414, June, 1982. 1 Fig, 6 Tab, 9 Ref.

Descriptors: *Flood plain management, *Mathematical studies, *Water law, *Taxes, *Cost allocation, Interstate compacts, Flood control, Flood prevention, Projections, Future planning, Interstate commissions, Massachusetts, Connecticut, Recreation, Thames River.

Under the terms of the Thames River Valley Flood Control Compact, the state of Connecticut must pay Massachusetts 40% of the annual property tax losses suffered by seven Massachusetts towns where four flood control structures are located. In the present study, the alternative of a lump sum payment was examined which would be the proportion of total benefits (flood control plus recreation) which Connecticut receives, multiplied by the present value of projected tax losses in the seven towns. A survey was made to estimate the recreational benefits of the structures and their distribution. Equations for projecting future tax losses were generated from regression analysis of 1957 to 1978 tax loss data. Present tax loss values were determined using discount rates ranging from 6 to 12%. A feasible range of lump sum reimbursements as of 1979 was formulated. (Geiger-FRC)
W83-00005

IRRIGATION PLANNING IN THE TANA BASIN OF KENYA,
University Coll. of Swanea (Wales). Centre for Development Studies.
S. K. Saha.
Water Supply and Management, Vol 6, No 3, p 261-279, 1982. 3 Fig, 5 Tab, 31 Ref.

Descriptors: *Kenya, *Social impact, *Irrigation programs, *Ecological effects, Tana River basin, *Water resources development, Rural areas, Social aspects, Environmental effects, Water management, Water policy, Regional planning, Planning, Irrigation practices, Rural sociology.

Kenya's current population growth rate is among the highest in the world. For this reason, the country is becoming more dependent on food imports and needs to convert its rain-fed agriculture into irrigated agriculture. As a result, the Tana River basin has been targeted as a massive irrigation development site. In designing the irrigation program, the social aspects of planning have been overlooked, making the project of little benefit to the poorer rural population of the basin. In order to make full use of their land holdings and cultivate the full hectarage, farmers will need more financial resources. The Mwea and Hola irrigation schemes have been only slightly more successful. Many smaller irrigation schemes are being planned for the Tana basin and other parts of Kenya. These too should include the social needs of the population in the planning process. (Geiger-FRC)
W83-00015

HYDROLOGY AND WATER RESOURCES OF THE DRAKENSBERG,
Natal Univ., Durban (South Africa). Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 4A.
W83-00085

SOCIAL AND POLITICAL ASPECTS OF DROUGHT,
Kraeger Associates, Ltd., Aptos, CA.
R. K. Kinsley.
Bulletin of the American Meteorological Society, Vol 63, No 6, p 586-592, June, 1982. 3 Fig, 1 Tab, 2 Ref.

Descriptors: *Water supply, *Water conservation, *Arid-zone hydrology, Political aspects, *Drought, Social aspects, Costs, Water resources development, Water scarcity, Water management, Arid lands, Semiarid lands, Water storage, Groundwater depletion.

The available surface water which can be put to beneficial use is far less than the mean annual flow of a stream, and is an inverse function of the coefficient of variation of the annual flows. In arid regions where the water needs are greater, the usable fraction of the flow is the least. When the coefficient of variation is unity, less than 80% of the mean annual flow is usable. When evaporation and instream flow maintenance are counted, this figure could be reduced to 50%. With moderate instream flow requirements, 66 to 75% of the mean flow may be usable, but this fraction will probably decrease when cost is considered. Groundwater may serve as an important reserve in time of drought, but only if its use is carefully managed. Drought may become increasingly more common in arid and semiarid regions, unless water resources are carefully watched. A reservoir will be of little use in dry regions unless its water supplies can be saved only for use periods during of drought. Much of the western United States is already using water at or above the effective maximum limits. The prospects for water supply development in these regions is poor and more frequent periods of drought should be expected. (Geiger-FRC)
W83-00186

A COOPERATIVE WATER RESOURCE TECHNOLOGY TRANSFER PROGRAM,
Michigan State Univ., East Lansing. Inst. of Water Research.
F. M. D'Itri.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-108266. Completion Report, June, 1982. 49 p, 12 Append. OWRT A-104-MICH(1), 14-34-0001-8024.

Descriptors: *Technology transfer, *Public participation, *Conferences, *Economic aspects, *Water quality, Water resource development, Eutrophication, Eutrophic lakes, Groundwater pollution, Irrigation practices, Storm water, Wastewater treatment, Acid rain, Regional analysis, Regional planning, Water quality control.

This cooperative water resource technology transfer program sought to develop/present educational programs (conferences/seminars/workshops) and technology transfer brochures to enhance public awareness/appreciation of State water quality problems and to stress economic tradeoffs needed to resolve given problems. Accomplishments of this program for the different conferences held 1979-1981 are described (inland lake eutrophication: causes, effects, and remedies; contamination of groundwater supplies by toxic chemicals: causes, effects, and prevention; supplemental irrigation; stormwater management; cooperative research needs for renovation and reuse of municipal water in agriculture; selection and management of vegetation for slow rate and overland flow land application systems to treat municipal wastewater; effects of acid precipitation on ecological systems: great Lakes region; water competition in Michigan; Michigan natural resources outlook). The project afforded opportunities for developing/disseminating printed materials, visual aids, and onsite exhibits. The conferences varied from regional programs for local citizens to international exchanges of scientific research data. It was not possible to assess the most significant aspect of the project for participants/recipients or short-long term results, however, the programs brought together citizens, scientists, and local/State representatives which generated a sense of working together to overcome problems of mutual concern. (Zielinski-MAXIMA)
W83-00216

CASE STUDY ANALYSES OF 208 PROGRAM EFFECTIVENESS IN IMPROVING REGIONAL WATER RESOURCES MANAGEMENT,
Brown and Caldwell, Pasadena, CA.
W. K. Ferry, W. O. Maddaus, D. G. Hurley, and W. J. Miller.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-108449, Price codes: A06 in paper copy, A01 in microfiche. Completion Report to Office of Water Research and Technology, Wash, DC, April, 1982. 94 p, 10 Fig, 11 Tab, 37 Ref. OWRT C-00071-U(0483)(1), 14-34-0001-0483.

Descriptors: *Case studies, *Water resource development, *208 Program, *Regional planning, *Institutional constraints, *Optimum development plans, Water resource institutes, Water management, Conservation, Water reuse, Public policy, Evaluation, Regional analysis, Regional development, Water quality, Water quality control, Low flow, Urbanization, Urban areas.

In order to identify more effective water resource management concepts applicable to urbanizing areas, problems and problem-solving activities of three regions which occurred before/during/after the 208 planning process were evaluated. The three case studies (San Diego area; San Francisco Bay area; Metropolitan Washington, DC area) were selected to focus on a variety of geographical areas, problems, levels of effort previously expended on water resources planning, and form of the existing management structure: Each water pollution control plan dealt with water supply, water conservation, and water reuse issues. In each case, the draft 208 plan, prepared to address regional solutions to common problems, were weakened to protect the traditional missions of local water agencies. Certain achievements were realized, including agreement on regional population growth to be accommodated by expanded water systems. Public involvement in water resources decisions was increased, and progress was made in improving the quality of water supplies. Cooperative benefits occurred during drought periods, partially due to the 208 process and its emphasis on regional cooperation (e.g., water exchanges, low flow agreements). While 208 effectiveness would have been enhanced if it had had a legal mandate for a regional water management plan, it did demonstrate how the underlying institutional framework reacts to regional water issues, and it did improve regional management. (Zielinski-MAXIMA)
W83-00240

HO: FOR REESE RIVER NATURAL RESOURCES OF THE TOIYABE-TOQUIMA HIGHLANDS, CENTRAL NEVADA,
Nevada Univ. System, Reno. Desert Research Inst.
J. M. Townley.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-108571, Price codes: A08 in paper copy, A01 in microfiche. Publication No 41075, April, 1982. 160 p, 4 Fig, 268 Ref. OWRT A-101-NEV(1), 14-34-0001-1130.

Descriptors: *History, *Nevada, *Reviews, *Resources development, *Land use, *Literature review, Water resources development, Regional development, Land development, Land clearing, Toiyabes, Recreation demand, Agriculture, Geologic history, Surveys, Institutional constraints, *Reese River.

An historical review is presented of issues which have underscored development of the Reese River Valley with respect to water and land resources, as part of a planned series examining the Humboldt River and its major tributaries. Interaction between natural resources and human occupation of this region in historic time is examined and interpreted. Maximum prosperity of the region was reached in the mid-1860's and, with short aberations, has never reawakened. Population density along the Toiyabes has never been great, but people most often resided in communities rather than dispersing on the land. Exploitation of natural resources provided the initial impetus for development in the area; however, since two major highways now bisect the area and the region contains vast open space areas, recreational activities now supplement the economy. This review covers the gradual, accidental, and the generally typical exploration of central Nevada, the 1862-1866 peak activity period (mining, milling) in central Nevada, changes since 1867, legend and tradition, the development of agriculture in the Toiyabe highlands, the Indian influence, and the camps of the Toiyabes. While current occupation offers the potential for threatening sources and existence of materials ranging from timber and wildlife to soil, surface and groundwater, this potential has not yet been exercised. (Zielinski-MAXIMA)
W83-00253

INCENTIVES FOR IRRIGATION WATER CONSERVATION IN AGRICULTURE,

Texas Tech Univ., Lubbock. Dept. of Industrial Engineering.
For primary bibliographic entry see Field 3F.
W83-00278

ESTIMATING HYDROLOGIC VALUES FOR PLANNING WILDLAND FIRE PROTECTION,
H. W. Anderson, and C. B. Phillips.
In: Proceedings of the Symposium on Dynamics and Management of Mediterranean-Type Ecosystems, June 22-26, 1981, San Diego, California, Pacific Southwest Forest and Range Experiment Station General Technical Report PSW-58, 1982, p 411-416, 2 Tab, 14 Ref.

Descriptors: *Fires, *Floods, *Sedimentation, *Water supply, *Hydrologic aspects, Cost-benefit analysis, *California, Watershed management, Mathematical models, Economic aspects.

Among the principal criteria for planning a system of wildland fire protection are measures of the values being protected. The cost of protecting these values is related to the economic and social benefits expected from them, the net effects that wildfire would have upon them in the absence of protection, the changes in fire effects that can be achieved by various levels and practices of fire protection, and of course, the people's ability and willingness to pay for protection. The expected net effects of wildfire on hydrologic values in a watershed are proportional to the hydrologic potential values in the watershed in the absence of fire, the probability of fires occurring at different sizes and frequencies under various levels of protection in the area, and the effects of those fires on the hydrologic potential values. Expected effects of wildland fires on hydrologic values have been indexed by 11 hydrologic parameters of floods, sedimentation and water supply. Coefficients and watershed attributes from 10 multiple-regression models are used to distribute measured hydrologic parameters throughout each watershed. Other coefficients are used with present fire condition and fire frequency to estimate changes in the hydrologic parameters for four fire conditions: unburned, 1% average annual burn, after a 100% burn, and after a burn of 10,000 acres (3900 ha). Application is illustrated for north coastal, Sierra Nevada, and southern California watersheds. (Moore-SRC)
W83-00306

HIGH PLAINS-OGALLALA AQUIFER STUDY, NEW MEXICO -- ECONOMIC IMPACTS,
New Mexico State Univ., Las Cruces. Dept. of Agricultural Business.
R. R. Lansford.
In: Proceedings of the Twenty-Seventh Annual New Mexico Water Conference, Hope for the High Plains, April 1-2, 1982. WRRI Report No 145, May 1982. p 47-68. 10 Fig, New Mexico Water Resources Research Institute, New Mexico State University, Las Cruces.

Descriptors: *Water management, *Resources management, *Economic impact, *Aquifer management, *Aquifer systems, Water demand, Water shortage, Water supply, Irrigation programs, Irrigation effects, Crop production, Population dynamics, Model studies, Linear programming, Input-output analyses, *New Mexico, *Ogallala Aquifer.

Extensive exploitation of New Mexico's High Plains groundwater resources has taxed supplies to the extent that some irrigated areas have ceased production and other economic activities are threatened. The purpose of this study was to estimate the economic impacts of several conditions over a 40-year planning horizon. This article summarizes the on-farm and regional impacts for two sub-regions of the High Plains area. An aggregate linear programming model was designed to maximize returns to land and management from crop and livestock enterprises and an input/output model was used to evaluate regional economic impacts resulting from alternative management strategies, i.e., voluntary water demand reduction, mandatory supply reduction, and augmentation. Crop acreage in the Northern Plains is expected to increase steadily by county and under all management strategies; no irrigated areas are expected to stop production. In the Southern area, significant shifts from irrigated to dryland production are expected. Cropping patterns will be affected more in the Southern than the Northern areas because of water shortages. Cotton and alfalfa acreage is expected to increase while grain sorghum declines. In the North, water applications per acre for all crops except pasture are expected to decline due to increasing field efficiency while in the South reductions are expected due to water shortages. Gross output is expected to increase sporadically from $2,384 million in 1977 to $2,704 million in 2020. Total employment will vary but is expected to be 32,248 in 1977, 69,646 in 1985, and decreasing to 32,211 in 2020. Baseline population is expected to go from 136,284 in 1977 down to 108,481 in 2020. (Atkins-Omniplan)
W83-00308

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

LUMP SUM TAX LOSS REIMBURSEMENT UNDER THE THAMES RIVER FLOOD CONTROL COMPACT,
Massachusetts Univ., Amherst. Dept. of Food and Resource Economics.
For primary bibliographic entry see Field 6B.
W83-00005

6D. Water Demand

THE NATION'S WATER,
K. McCray.
Water Well Journal, Vol 36, No 7, p 48-52, July, 1982.

Descriptors: *Water supply, *Water management, Groundwater, Aquifers, Irrigation, Water pollution, Prediction, Forecasting, Water demand, Water use, Water shortage.

The state of the nation's water is examined in a sampling of recent newspaper reports from different regions of the country. In the Midcontinent concern about water depletion prevailed in articles about renewal of irrigation permits, secondary sources for municipal supplies, new wells drilled during drought, and low levels in Texas' Edwards aquifer. In the Northeast the three New York reservoirs of the Delaware River Basin Comission were at 56% of capacity in February 1982. Salt intrusion in the Delaware River reached within a few miles of contaminating Camden wells. Water levels in Long Island's lakes and ponds will drop during the next 8 years. Rhode Island's governor favored water conservation over development of new supplies. In the Southeast, voluntary water conservation was suggested in South Florida, groundwater levels are declining along Florida's east coast, and water shortages could affect electricity production. A lack of data on groundwater resources in Tennessee is a serious problem. In the West water reuse is in the news in Los Angeles and Orange County; Senate Bill 200, authorizing the Peripheral Canal and augmentation of the state's water facilities, was due for a vote in June, 1982. Applications for water rights imperil existing domestic well supplies in Colorado. In the Great Lakes states drought plans were being developed for Illinois. Tapping Lake Michigan by Chicago suburbs not near the lake was condemned as expensive. Kalamazoo, Michigan, is counting on groundwater as supplies for the foreseeable future. Abundant water will be an even larger factor in the development of Ohio's industry. Projections for Wisconsin are increases in agricultural use and decreases in industrial use. However, groundwater pollution by nitrates from fertilizers is being detected in some Wisconsin wells. (Cassar-FRC)
W83-00004

THE OGALLALA--HALF FULL OR HALF EMPTY.,
K. McCray.
Water Well Journal, Vol 36, No 7, p 53-62, July, 1982. 5 Fig.

Descriptors: *Agriculture, *Aquifer management, *Economic aspects, Water management, *Ogallala Aquifer, High Plains Aquifer, *Texas, Soil erosion, Pumping, Wells, Planning, Water supply, Water consumption, Water policy, Water conservation, Water shortage, Water demand, Water table decline, Groundwater mining, *Groundwater depletion, Groundwater irrigation, Groundwater management, Irrigation efficiency.

The Ogallala Aquifer is an irregular unconfined aquifer within a 400 mile wide and 800 mile long area from South Dakota to Texas, including small sections of Colorado, Kansas, Nebraska, New Mexico, and Wyoming. Its 1 quadrillion gal of water are vital to agriculture and to the 2 million people living in the region. A survey indicates that 5% of the entire aquifer has been drained at a rate of 14 million acre-feet per year. The saturated thickness has declined more than 10% under a fourth of the total aquifer area. The greatest well level declines, 200 ft, have been in Floyd County, Texas. Average depletions are: Nebraska, 1%; Kansas, 8%; New Mexico, 16%. Within 25 years Colorado's share of the Ogallala will be 40% depleted. There are differing opinions on the future of agriculture in the Ogallala region. Since less water will be available, it is expected that agricultural patterns will change. The beef cattle industry will shift from Texas and Oklahoma to Nebraska and Kansas: Texas and New Mexico will grow cotton and wheat. Consequences of a switch to dry farming may include great increases in erosion. Suggestions for improving water management are conjunctive water use, land leveling, skip row irrigation, night-time watering, improved sprinklers, demand watering, tax incentives, weather modification, artificial recharge, and proper well design and operation. An extensive system of 280 ft wide canals to tap rivers in Missouri and Arkansas has been proposed. (Cassar-FRC)
W83-00017

6E. Water Law and Institutions

LAW,
Virginia Water Resources Center, Blacksburg.
W. R. Walker.
Journal of the Water Pollution Control Federation (Literature Review Issue), Vol 54, No 6, p 513-519, June, 1982. 55 Ref.

Descriptors: *Literature reviews, *Water law, *Regulations, *Reviews, Water rights, Legislation, Wastewater treatment, Legal aspects, Judicial decisions, Public participation, Nonpoint pollution sources, Common law, Permits, Oil shale, International law, Groundwater pollution, Landfills, Industrial wastewater, Municipal wastewater, Law enforcement.

Recent literature on water law was dominated by application, interpretation, and proposed revisions of federal legislation and the new philosophy of the Reagan administration on the role of government in pollution control. The Clean Water Act was challenged by some authors who felt that water quality goals should be decided on the watershed level rather than on the federal level. Difficulties of enforcing water pollution control laws against publicly owned treatment works were pointed out. Decisions in several cases indicated that public participation in the permit process is not necessary. Many EPA regulations were challenged in court cases. The Best Conventional Technology regulations were ruled invalid because a cost effectiveness analysis had not been prepared. The EPA was forced to consider ocean dumping as a viable sludge disposal alternative. History of and challenges to the Resource Conservation and Recovery Act (1976) were the subjects of several papers. Other aspects of water quality law discussed were: effectively dealing with instream uses to preserve water quality and serve other purposes, challenges to the Surface Mining and Reclamation Act of 1977, the impact of oil shale development on water quality, pollution problems which transcend national boundaries, public participation and protection of citizen's rights, suits concerning contamination or potential contamination of ground-

water supplies, pretreatment of industrial wastes, and hazardous waste landfills. (Cassar-FRC)
W83-00165

U.S. GEOLOGICAL SURVEY FEDERAL-STATE PROGRAM,
Geological Survey, Reston, VA.
T. J. Buchanan, and B. K. Gilbert.
Journal of the Water Resources Planning and Management Division, Proceedings of the American Society of Civil Engineers, Vol 108, No WR1, p 37-45, March, 1982. 1 Fig, 3 Tab, 9 Ref.

Descriptors: *Water use, *Water supply, *Water quality, *Interagency cooperation, *Data collections, *Data acquisition, Data interpretation, Governmental interrelations, Water demand, Water management, Water resources development.

The U. S. Geological Survey Federal-State Cooperative Water Resource Program provides matching funds for joint water resources investigations by the Geological Survey and State and local agencies. The primary objectives of the program are to collect on a systematic basis data needed for the continuing determination and evaluation of the quantity, quality, and use of water resources and to conduct analytical and interpretive appraisals of the current availability and the physical, chemical and biological characteristics of surface and groundwater resources. While all projects must be proposed by the cooperating State or local agency, matching funds are made available in accordance with Federal guidelines with respect to needs and priorities. Since the Geological Survey performs most of the work on the projects, the program results in the development of a coherent and comparable national data base on water resources. Although total funding for the program is now more than $80 million per year, many proposed projects cannot be funded. Sample projects include evaluation of landfill leachate plume effects on groundwater, development of mathematical models of aquifer response and of water quality models, investigation of pollution sources, and development of estimates of flood heights. Water data and investigation results are disseminated through reports, maps, computerized information services, and other forms of public releases. (Carroll-FRC)
W83-00201

THE PLIGHT OF AMERICAN CITIZENS INJURED BY TRANSBOUNDARY RIVER POLLUTION,
D. C. Arbitblit.
Ecology Law Quarterly, Vol 8, No 2, p 339-370, 1979. 190 Ref.

Descriptors: *Liability, *International law, *Legal aspects, Judicial decisions, Canada, Powerplants, Water pollution, Jurisdiction, Torts, Treaties, Water law, Rivers, Boundary Waters Treaty, International Joint Commission, Foreign Sovereign Immunities Act, Coal mining, Diversion, Water quality.

Legal remedies available to American citizens suffering damages from pollution originating in Canada are described. Ineffective measures include direct action against Canadian polluters, the provisions of the Boundary Waters Treaty, and the International Joint Commission. One possibility for recovering damages is the Foreign Sovereign Immunities Act of 1976. The thesis of this paper is that foreign nations have a duty to avoid transboundary pollution and to prevent private parties from causing transboundary pollution. A suit under this act would give American citizens a means to enforce this duty against the Canadian government. The suit would be based on a tort duty imposed by international law and derived from customary international law principles and the Helsinki Rules. Several proposed potentially-polluting projects are discussed. A massive coal-fired power station recently completed in Saskatchewan and a coal mining operation in British Columbia threaten Montana plains and wilderness regions, including the Flathead River and Lake. Conversely, the Garrison Diversion Unit, a proposed irrigation project, threatens the quality of water entering Canada from the Souris River, North Dakota. Several related court cases and their results are reviewed. (Cassar-FRC)
W83-00209

THE CLEAN WATER ACT'S SECTION 404 PERMIT PROGRAM ENTERS ITS ADOLESCENCE: AN INSTITUTIONAL AND PROGRAMMATIC PERSPECTIVE,
Lewis and Clark Law School, Portland, OR.
For primary bibliographic entry see Field 5G.
W83-00210

ANALYSIS OF LEGAL AND INSTITUTIONAL ARRANGEMENTS AFFECTING WATER ALLOCATION AND USE IN NEBRASKA,
Nebraska Univ.-Lincoln. Coll. of Law.
N. W. Thorson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-108548, Price codes: A03 in paper copy, A01 in microfiche. Nebraska Water Resources Center Completion Report, Nebraska University, Lincoln, July, 1982. 44 p. OWRT A-052-NEB(1), 14-34-0001-9029.

Descriptors: *Institutional constraints, *Legal aspects, *Water rights, *Water allocation, *Water use, *Nebraska, Water policy, Water planning, Resource allocation, Riparian rights, Interstate compacts, Federal jurisdiction, Political aspects, Groundwater management, Policy making, Administrative decisions, Public policy.

Selected water rights issues were examined to assess the strengths/weaknesses of existing law, the needs/opportunities foregone under existing law, and alternative potential legislative policy positions which might be adopted in light of the identified needs/opportunities. Eight separate areas were analyzed in coordination with the Nebraska State Water Planning and Review Process: preferences in water use; diffused surface water drainage; beneficial use; groundwater property rights; water right adjudications; inte grating riparian and appropriative rights; su-face water rights transfers; and interstate water uses/conflicts. Some 135 policy alternatives/sub-alternatives were developed and analyzed with the eight study areas. Major deficiencies in current law were identified. These included: an inflexible preference system conflicting with economic reality; critical terms unclearly defined under current law; confusing/unpredictable rules governing use/disposition of diffused surface waters; inadequate urban runoff control; lack of systematic effort to protect critical wetlands; legal uncertainty of the nature/scope of groundwater property rights; lack of procedure to adjucate Federal/Indian water rights. (Zielinski-MAXIMA)
W83-00250

WATER LAW PRIMER,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Civil Engineering.
W. E. Cox.
Journal of the Water Resources Planning and Management Division, Proceedings of the American Society of Civil Engineers, Vol 108, No WR1, p 107-122, March, 1982. 25 Ref.

Descriptors: *Water law, *Legal aspects, *Water use, *Water pollution control, Groundwater management, Groundwater pollution, Surface water, Surface drainage, Watercourses, Water rights, State jurisdiction.

An overview of legal principles controlling the use and development of water resources is presented. The overview is designed primarily for use by engineers and others who do not have a background in water law but who need a concise treatment of basic issues. While laws pertaining to the allocation of water resources have generally originated at the State level, Federal laws have a greater role in the protection of water quality. With respect to watercourse law, which applies to water in streams and lakes, the two major doctrines are the riparian doctrine, which is dominant in the eastern United States, and the doctrine of prior appropriation, which is dominant in the west. There are four doctrines which are generally recognized with respect to ground water use: absolute ownership, reasonable use, correlative rights, and appropriative rights. The three major doctrines which have been developed to deal with diffused surface water drainage are the common enemy doctrine, the civil law doctrine, and the reasonable use doctrine. Laws relating to pollution of watercourses, groundwater, and diffused water are also reviewed briefly. (Carroll-FRC)
W83-00318

6G. Ecologic Impact Of Water Development

ENVIRONMENTAL IMPACT OF LARGE HYDROELECTRIC PROJECTS ON TROPICAL COUNTRIES,
Texas Univ. Health Science Center at Houston. School of Public Health.
F. Szekely.
Water Supply and Management, Vol 6, No 3, p 233-242, 1982. 3 Tab, 19 Ref.

Descriptors: *Dam effects, *Social impact, *Water resources development, *Hydroelectric power, Dams, Environmental effects, Ecological effects, Erosion, Human diseases, Developing countries, Aquatic weeds, Public health, Water quality, Water supply.

The effect of large hydroelectric plants on the environment in underdeveloped countries is examined. The construction of hydroelectric dams produces social impacts through the displacement of local populations without due compensation. Tropical diseases arising from the operation of high dams impose a social cost upon the communities in close proximity to the project. These diseases arise due to unsuitable living conditions and lack of sanitation as well as from the alteration of the natural ecological cycle through the introduction of a body of water. Schistosomiasis is one of the diseases most commonly associated with the operation of large dams located in tropic regions. The Chinese example in handling the snail-host aspect of schistosomiasis is a proper path to follow in handling the negative impacts of resource development. This campaign against schistosomiasis included making the snail's habitat uninhabitable for the mollusk, properly disposing of human wastes, maintaining proper water supplies, localizing infected individuals for treatment, and starting a mass education program. Other negative environmental effects are also noted. Problems of aquatic weed overgrowth already exist in several dams in Mexico. Erosion often takes place at the mouth of rivers whose waters have been harnessed for hydroelectric power production. As a possible solution, a new type of development (ecodevelopment) is recommended. This plan advocates the rational use of natural resources while meeting the needs of the population and balancing the interrelation between man and the environment. (Geiger-FRC)
W83-00010

THE ECOLOGY OF THE MANGROVES OF SOUTH FLORIDA: A COMMUNITY PROFILE,
Virginia Univ., Charlottesville. Dept. of Environmental Sciences.
W. E. Odum, C. C. McIvor, and T. J. Smith, III.
Fish and Wildlife Service, Office of Biological Services Report FWS/OBS-81/24, January 1982. 154 p, 18 Fig, 10 Tab, 353 Ref, 5 Append.

Descriptors: *Florida, *Mangrove swamps, *Ecosystems, *Natural resources, *Wildlife habitats, Environmental effects, Coastal marshes, Salinity, Water pollution effects, Dikes, Floods, Tidal effects, Salinity, Wetlands, Particulate matter, Ecological distribution.

Based upon a compilation of data from published and unpublished sources, the community structure and ecosystem processes of the mangrove forests of south Florida are described in detail. It is concluded that mangrove forests, which cover between 430,000 and 500,000 acres (174,000-202,000 ha) in Florida, are a resource of great value and should be protected and preserved whenever possible. Four major factors appear to limit the distribution of mangroves and determine the extent of

mangrove ecosystem development. These factors include: climate; salt water; tidal fluctuation; and substrate. In general, the surface waters associated with mangroves are characterized by: a wide range of salinities, from virtually fresh water to above 40 ppt; low macronutrient concentrations; relatively low dissolved oxygen concentrations; and frequently, increased water color and turbidity. Man-induced destruction of mangrove forest in Florida has occurred in various ways, including outright destruction and land filling, diking and flooding, through introduction of fine particulate material which clogs aerial roots, and pollution damage, particularly oil spills. Total loss statewide is probably in the range of 3 to 5% but losses in specific areas are appreciable. At no cost to man, mangrove forests provide habitat for valuable birds, mammals, amphibians, reptiles, fishes, and invertebrates and protect endangered species, at least partially support extensive coastal food webs, provide shoreline stability and storm protection, and generate aesthetically pleasing experiences. (Moore-SRC)
W83-00093

AN ALTERNATIVE TO THE PERIPHERAL CANAL,
California Univ., Davis. Dept. of Civil Engineering.
G. T. Orlob.
Journal of the Water Resources Planning and Management Division, Proceedings of the American Society of Civil Engineers, Vol 108, No WR1, p 123-141, March, 1982. 7 Fig, 2 Tab, 5 Ref.

Descriptors: *Water transfer, *Estuaries, *Deltas, Simulation analysis, Mathematical models, Water quality, Saline water intrusion, Water conveyance, *Alternative planning, *California, Sacramento River, San Joaquin River.

The present system of water conveyance through the Sacramento-San Joaquin Delta in California is not adequate to meet future export requirements and to maintain desired water quality. State agencies and water delivery contractors in Southern California favor construction of the proposed 42-mile-long Peripheral Canal, which would convey project water around the estuary. However, Northern Californian water interests oppose this project, perferring an 'open' water transfer alternative. Mathematical models of the Delta estuarial system were used to compare the hydrodynamic and water quality responses of the estuary under conditions of future operation for the present water transfer method, for the peripheral canal, and for an alternative open transfer system. The simulation analysis indicated that all three alternatives could control salinity intrusion in the western Delta. While the peripheral canal was shown to be capable of maintaining net seaward flow in most channels, both the open water alternative and the present system caused 'upstream' flow in channels leading to export pumps due to their through-Delta nature. Analysis of water quality responses indicated that the use of the present system could be expected to result in unacceptable conditions in the western and southern channels, while the peripheral canal would allow significant degradation in the extreme southern delta channels. The alternative open water transfer plan resulted in generally excellent water quality in the northern, central, and southern Delta. The alternative plan appears to be capable of meeting water quality objectives throughout the Delta while assuring delivery to the pumping stations of water of a quality adequate for all intended uses in service areas to the south. (Carroll-FRC)
W83-00193

THE ROLE OF HYDROLOGIC VARIABILITY IN COMPLYING WITH REGULATORY ENFORCEMENT STANDARDS FOR THE REHABILITATION OF SURFACE-MINED COAL LANDS,
Arizona Univ. Tucson. Dept. of Hydrology and Water Resources.
L. H. Hekman, Jr., D. R. Davis, and M. M. Fogel.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-108316, Price codes: A05 in paper copy, A01 in microfiche. Completion Report, June, 1982. 84 p, 10 Fig, 5 Tab, 64 Ref, 3 Append. OWRT B-073-ARIZ(1), 14-34-0001-9056.

Descriptors: *Hydrologic cycle, *Legal aspects, *Land reclamation, *Coal mining, *Model studies, Hydrologic data, Hydrologic properties, Hydrologic budget, Regulations, Enforcement, Rehabilitation, Regeneration, Surface runoff, Computer models, Mathematical models, Land management, Land resources, Land development, Strip mines, Coal mines, Coal, Precipitation.

It was determined that hydrologic variability affects surface mining regulation compliance, principally through precipitation. Specifically, studies of sediment control, revegetation, and aquifer testing show regulations which do not consider that the inherent natural/sample/model uncertainties can be inefficient both economically and environmentally. A consideration of the uncertainty in the regulatory process requires both objective and subjective information. This includes uncertainty quantification, a precise knowledge of regulatory goals and their relative importance, and a criterion to resolve the uncertainty. However, there is a paucity of such information for surface mining regulations. While the uncertainties and their effects may be quantified, the second and third types of information are neither stated in the Surface Mining Act (SMA) or the regulations, nor uniquely implied in legislative/regulatory history. However, politically, the SMA and the regulations may be considered as efficient, due to the concerns of the time. In essence, proper attention to the scientific aspects alone, can improve regulatory effort efficiency in many individual cases. Hence, variability in the natural hydrologic regime and parameter/models uncertainty used to describe this regime has led to inefficient surface mining regulatory compliance as applied to semi-arid areas. Methods were developed for studying/analyzing the uncertainty and its effect. (Zielinski-MAXIMA)
W83-00223

FINAL ENVIRONMENTAL IMPACT STATEMENT OF THE WHITE RIVER DAM PROJECT.
Bureau of Land Management, Vernal, UT.
Report, May 1982. 389 p, 38 Fig, 30 Tab, 191 Ref, 12 Append.

Descriptors: *Environmental Impact Statement, *Dam effects, *Environmental effects, *White River, *Water resources development, *Hydroelectric plants, *Utah, Reservoirs, Salinity, Colorado river, Fish populations, Oil shale, Energy resources development, Fish conservation, Cost analysis.

The environmental consequences of five alternatives designed to supply water for energy development, including oil shale, in Uintah County, Utah, were assessed. The alternatives include; construction of the White River Dam, reservoir, and hydroelectric plant; No Action; pumping from the White River and augmenting from Hell's Hole Canyon Dam; pumping from Green River; pumping from White River and supplementing with water pumped from the Green River. The White River Dam would create a 11.7 mile long reservoir with 1980 surface acres. Also proposed are a 15 MW hydroelectric power plant, power transmission system, recreational facilities, and access roads. Three species of rare endemic fish (Colorado squawfish, humpback chub, and bonytail chub) have been observed in portions of the White River in Utah and are listed as endangered. However, with implementation of the operation procedures and conservation measures recommended in the Fish and Wildlife Biological Opinion, the White River Dam Project would not likely jeopardize the continued existence of the endangered fishes. A depletion of 75,000 acre-feet of water from the White River would result in an increase in salinity of Imperial Dam on the Colorado River of 4.1 mg/1. A rough water supply cost comparison indicates that the White River Dam and Reservoir would be the least expensive alternative, and this alternative would be the only producer of energy. There are still unresolved issues regarding future water allocations in the White River. (Moore-SRC)
W83-00297

7. RESOURCES DATA

7A. Network Design

WATER-RESOURCES INVESTIGATIONS OF THE U.S. GEOLOGICAL SURVEY IN NEW MEXICO, FISCAL YEAR 1980.
Geological Survey, Albuquerque, NM. Water Resources Div.
Available from the OFSS, USGS Box 25425, Fed. Ctr. Denver, CO 80225, Price: $5.25 in paper copy, $3.50 in microfiche. Open-File Report 82-267, February 1982. 36 p, 5 Fig, 24 Ref. (Compiler, R. R. White).

Descriptors: *Data collections, *Groundwater, *Surface water, Network design, Available water, Water quality, Publications, *New Mexico.

This is the third in a series of annual reports in which the program of the New Mexico District, U.S. Geological Survey, Water Resources Division, is summarized. This report, which is for fiscal year 1980, may be of use to cooperating agencies and to the users of water data in that it summarizes and gives the status of the basic data-collection program and all current studies of the Water Resources Division in New Mexico. The New Mexico District, along with other Federal and State agencies, shares in the responsibility for the appraisal of the quantity, quality, and distribution of surface- and ground-water resources of the State of New Mexico. During fiscal year 1980, the District had 28 active projects, had released 24 reports, and had answered hundreds of requests for water-related information. (USGS)
W83-00073

U.S. GEOLOGICAL SURVEY FEDERAL-STATE PROGRAM,
Geological Survey, Reston, VA.
For primary bibliographic entry see Field 6E.
W83-00201

DESIGN OF MONITORING STUDIES FOR PRIORITY POLLUTANTS,
E.V.S. Consultants, Ltd., Vancouver (British Columbia).
P. M. Chapman, G. P. Romberg, and G. A. Vigers.
Journal of the Water Pollution Control Federation, Vol 54, No 3, p 292-297. March, 1982. 1 Fig, 2 Tab, 2 Ref.

Descriptors: *Monitoring, *Pollutant identification, Bioaccumulation, Accumulation, Toxins, Chemical compounds, Sediments, Biota, Water pollution, Data collections, Chemical analysis, Networks.

The U.S. Environmental Protection Agency has published a list of 65 classes of toxic chemicals, numbering 126 compounds, for which the agency intends to develop discharge control standards. In order to design and implement financially and scientifically credible surveillance programs for these priority pollutants, it is first necessary to develop a selective rationale to reduce specific programs to manageable proportions. The current state of knowledge regarding the fate and effects of the priority pollutants has been summarized in a convenient tabular form which characterizes compounds on the basis of persistence, accumulative capacity, and volatility and which identifies the environmental compartment (water, sediment, or biota) of major concern for each compound. Although the rationale used in setting priorities for these pollutants and the environmental compartments may be oversimplistic for some situations, the approach provides a basic rational framework for designing and initiating an environmental monitoring program for the pollutants. The information should permit the design of individual monitoring programs in a cost-effective manner based on sound scientific principles. (Carroll-FRC)
W83-00321

7B. Data Acquisition

MANUAL FOR LEVELING AT GAGING STATIONS IN NORTH CAROLINA,
Geological Survey, Raleigh, NC. Water Resources Div.
N. O. Thomas, and N. M. Jackson, Jr.
Available from the OFSS, USGS Box 25425, Fed. Ctr. Denver, CO 80225, Price: $5.25 in paper copy, $3.50 in microfiche. Open-File Report 81-1104, October 1981. 37 p, 13 Fig.

Descriptors: *Training, *Data collections, *Stream gages, *Water level, Measuring instruments, Gaging stations, Civil engineering, Technology, *North Carolina.

This manual was prepared to serve several purposes in the U.S. Geological Survey North Carolina District. This manual sets forth District policy as to frequency of levels, accuracy criteria, procedures for checking the datum and setting of the various types of gages, general rules to follow in establishing the original datum of a gage, and contains sample notes to be used as guides in level notekeeping. The manual also serves as a training tool in that the reasoning behind District policy is explained and reasons are given for following the recommended techniques to assist in a better understanding of the purpose of levels and maintaining gage datum. (USGS)
W83-00065

ADAPTATION OF THE ILLUDAS MODEL TO A DESK-TOP COMPUTER,
Canada Centre fro Inland Waters, Burlington (Ontario).
J. Marsalek.
National Water Research Institute, Technical Bulletin No 120, 1981. 45 p, 7 Fig, 22 Tab, 5 Ref, 1 Append.

Descriptors: *Computers, *Computer programs, *Urban runoff, *Urban drainage, *Hydrograph analysis, Computer models, Model studies, Mathematical studies, Engineering, Design criteria, Data interpretation, Data processing, Runoff forecasting, Runoff, Runoff rates, Runoff volume, Mathematical models, Hyetographs, Statistical analysis, Rainfall, Sensitivity analysis.

Computer models for engineering design use require correct verification to establish reliable results; such verification is provided for a new technique that clearly shows that reliable results are obtainable for a modified urban runoff model (Illinois Urban Drainage Area Simulator; ILLUDAS) by using lower-cost desk-top computers. The results can be used wherever runoff rates and quantities must be computed from rainfall events. The standard version of the ILLUDAS model written for the IBM 360/75 computer was modified and adapted to a Hewlett-Packard 9830 desk-top computer. The modified model was verified on a test catchment and subjected to a sensitivity analysis. For a small catchment with simple flow routing, the modified model performed equally as well as conventional models requiring large computer systems. The modified model not only retained all of the features of the original model, but was further expanded for a number of new features. These new features included: interactive program operation, multiple rainfall hyetographs, input of hydrographs from upper reaches, optional calculation of inlet times, storage of flows on street surface, approximately analysis of pressurized flow in sewers, dry weather flow, and statistical analysis of simulated/observed hydrographs. (Zielinski-MAXIMA)
W83-00081

7C. Evaluation, Processing and Publication

WATER RESOURCES DATA, LOUISIANA, WATER YEAR 1981--VOLUME 2. SOUTHERN LOUISIANA.
Geological Survey, Baton Rouge, LA. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as Water-Data Report LA-81-2, 1981. 327 p, 18 Fig.

Descriptors: *Hydrologic data, *Surface water, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Wells, Water level, Data collections, Sites, *Louisiana, Southern Louisiana.

Water resources data for the 1981 water year for Louisiana consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels and water quality of ground water. This report, in three volumes, contains records for water discharge at 81 gaging stations (including stage for 76 of these stations); stage only for 37 gaging stations and 10 lakes; contents for 1 reservoir; water quality for 142 surface-water stations (including 35 gaging stations), 27 miscellaneous sites, 10 lakes, and 286 wells; and water levels for 679 observation wells. Also included are data for 250 crest-stage and flood-profile partial-record stations. Additional water data were collected at various sites not involved in the systematic data-collection program, and are published as miscellaneous measurements. Records for a few pertinent stations in bordering States are also included in this report. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in Louisiana. (USGS)
W83-00057

CARROLL COUNTY GROUND-WATER INFORMATION: WELL RECORDS, SPRING RECORDS, AND CHEMICAL-QUALITY DATA.
Geological Survey, Towson, MD. Water Resources Div.
Maryland Geological Survey, Water Resources Basic Data Report No 12, 1981. 251 p, 29 Fig, 4 Tab, 14 Ref. (Compiled by J. T. Hilleary and J. M. Weigle).

Descriptors: *Groundwater, *Water quality, *Data collections, *Chemical analysis, Springs, Water wells, Well data, Well yield, Aquifer characteristics, Water sampling, Sites, Maps, *Maryland, Carroll County, Piedmont Province.

This report is a compilation of water-well records, spring records, chemical-quality data and water-use data for Carroll County, Maryland. The report contains records of 3,224 water wells, 75 springs, and 159 chemical analyses of ground water. (USGS)
W83-00058

GEOHYDROLOGY OF SOUTHWESTERN KANSAS,
Geological Survey, Lawrence, KS. Water Resources Div.
E. D. Gutentag, D. H. Lobmeyer, and S. E. Slagle.
Univ. of Kansas Publ. Lawrence, Kans. Kansas Geological Survey, Irrigation Series 7, 1981. 73 p, 14 Fig, 3 Plates, 4 Tab, 48 Ref.

Descriptors: *Hydrologic data, *Groundwater potential, *Geohydrology, *Aquifer characteristics, Irrigation wells, Pumping, Water level, Water use, Available water, Water quality, Chemical analysis, Hydrologic cycle, Maps, *Southwestern Kansas, High Plains, Arkansas River, Cimarron River.

The study area covers about 8,900 square miles and includes Finney, Grant, Gray, Hamilton, Haskell, Kearny, Meade, Morton, Seward, Stanton, and Stevens Counties, Kansas. Normal annual precipitation near the center of the area is 19.45 inches. About 75% of the area is underlain by sufficient saturated thickness of unconsolidated aquifer to yield water for irrigation. Water in the aquifer ranges from a calcium bicarbonate type with moderate salinity, usable for most purposes, to a sodium chloride type, too highly saline for most purposes. Water available for pumping is estimated to be about 105 million acre-feet (1975). Recharge from precipitation is calculated to be 210,000 acre-feet per year. The amount removed from storage since 1940 is about 14 million acre-feet. About 1.4 million acres were irrigated from about 7,000 wells in 1975. The net withdrawal rate in 1974 is estimated to be 1.7 to 2.2 million acre-feet per year. (USGS)
W83-00059

LOW-FLOW CHARACTERISTICS AND FLOW DURATION OF NEW JERSEY STREAMS,
Geological Survey, Trenton, NJ. Water Resources Div.
B. D. Gillespie, and R. D. Schopp.
Available from the OFSS, USGS Box 25425, Fed. Ctr. Denver, CO 80225, Price: $22.00 in paper copy, $3.50 in microfiche. Open-File Report 81-1110, January 1982. 164 p, 15 Fig, 10 Ref.

Descriptors: *Streamflow, *Low flow, *Flow characteristics, *Flow duration, Surface water, Gaging stations, Sites, Discharge measurement, Base flow, Frequency analysis, Data collections, *New Jersey.

Low-flow frequency and flow-duration data for 400 continuous-record and partial-record gaging stations in New Jersey are tabulated in this report. The amount of data analyzed at each site varies from the complete daily discharge record for continuous-record gaging stations, some of which have been in operation for over 50 years, to limited discharge measurements for partial-record sites. Daily discharges for continuous-record stations with 7 or more years of record were analyzed by digital computer. From these computer summaries, low-flow frequency tables for all gaging stations on unregulated streams with 10 or more years of record were tabulated. Flow-duration tables were also compiled for streams with at least 7 years of streamflow records. For continuous-record gaging stations with less than 10 years of record, for highly regulated streams, and for partial-record sites, only observed or estimated annual minimum mean discharges for 7 consecutive days with recurrence intervals of 2 and 10 years are given. (USGS)
W83-00061

REPORT OF THE ANNUAL YIELD OF THE ARKANSAS RIVER BASIN FOR THE ARKANSAS RIVER BASIN COMPACT, ARKANSAS--OKLAHOMA, 1980 WATER YEAR,
Geological Survey, Little Rock, AR. Water Resources Div.
For primary bibliographic entry see Field 4A.
W83-00063

INSTALLATION AND SAMPLING OF OBSERVATION WELLS AND ANALYSES OF WATER FROM THE SHALLOW AQUIFER AT SELECTED WASTE-DISPOSAL SITES IN THE MEMPHIS AREA, TENNESSEE,
Geological Survey, Memphis, TN. Water Resources Div.
For primary bibliographic entry see Field 5B.
W83-00066

GEOHYDROLOGY OF THE VALLEY-FILL AQUIFER IN THE SOUTH FALLSBURGH-WOODBOURNE AREA, SULLIVAN COUNTY, NEW YORK,
Geological Survey, Albany, NY. Water Resources Div.; and New York State Geological Survey/State Museum, Albany.
H. R. Anderson, R. J. Dineen, W. G. Stelz, and J. L. Belli.
Available from the OFSS, USGS Box 25425, Fed. Ctr. Denver, CO 80225, Price: $17.00 in paper copy, $3.00 in microfiche. Open-File Report 82-112, 1982. 6 sheets, 5 Ref.

Descriptors: *Geologic mapping, *Groundwater, *Aquifers, *Groundwater movement, Aquifer characteristics, Well yield, Permeability, Groundwater level, Land use, Geohydrology, Hydrologic data, *New York, Sullivan County, Soil Permeability.

This report is the ninth in a series of map sets depicting geohydrologic conditions in selected

aquifers in upstate New York. Geohydrologic data are compiled on six maps at 1:24,000 scale. Together the maps provide a comprehensive overview of a major valley-fill aquifer in southeastern Sullivan County. The maps include surficial geology, geologic sections, aquifer thickness, water-infiltration potential of soil zone, potentiometric surface elevations, well yields, and land use. The valley-fill deposits consist of alluvial silt and sand, glacial outwash (sand and gravel), ice-contact sand and gravel, till, and lacustrine silt and clay. The sand and gravel beds have relatively high permeabilities whereas the till, silt, and clay deposits have relatively low permeabilities. Water-table conditions prevail in unconfined sand and gravel whereas artesian conditions prevail within sand and gravel confined by silty deposits. The aquifer is recharged throughout, where the land surface is most permeable and is greatest along the margin of the valley, where runoff from the hillsides is concentrated. The use of land overlying the aquifer is predominantly commercial, agricultural, and residential with lesser industrial uses. (USGS)
W83-00069

SELECTED HYDROLOGIC AND CLIMATOLOGIC DATA FROM THE PRAIRIE DOG CREEK BASIN, SOUTHEASTERN MONTANA, WATER YEAR 1980,
Geological Survey, Helena, MT. Water Resources Div.
L. E. Cary, and J. D. Johnson.
Available from the OFSS, USGS Box 25425, Fed. Ctr. Denver, CO 80225, Price: $10.00 in paper copy, $3.50 in microfiche. Open-File Report 82-273, March 1982. 74 p, 2 Fig, 42 Tab, 4 Ref.

Descriptors: *Data collections, *Hydrologic data, *Climatic data, Precipitation, Air temperature, Relative humidity, Solar radiation, Wind, Soil temperature, Soil water, Streamflow, Water quality, Chemical analysis, Suspended sediments, Model studies, *Montana.

Hydrologic and climatologic data are being collected in a 25-square-mile (65-square-kilometer) basin in southeastern Montana to provide a base for development, calibration, and verification of a precipitation-runoff model. The study area and data-collection stations within the area are shown on a map. A summary of data collected at each station during the second year, beginning in October 1979, is provided in tables. The data include precipitation, snow depth and water content, air temperature, relative humidity, wind speed and direction, solar radiation, soil temperature and moisture, stream discharge, chemical analyses of water, and suspended sediment. (USGS)
W83-00074

APPROXIMATELY WATER-LEVEL CHANGES IN WELLS IN THE CHICOT AND EVANGELINE AQUIFERS 1977-82 AND 1981-82, AND MEASURED COMPACTION 1973-82, IN THE HOUSTON-GALVESTON REGION, TEXAS,
Geological Survey, Houston, TX. Water Resources Div.
J. L. Strause, and C. E. Ranzau, Jr.
Available from the OFSS, USGS Box 25425, Fed. Ctr. Denver, CO 80225, Price: $5.00 in paper copy, $5.50 in microfiche. Open-File Report 82-328, March 1982. 5 Sheets.

Descriptors: *Aquifers, *Groundwater, *Wells, *Water level fluctuations, *Compaction, Land subsidence, Maps, *Texas, Chicot aquifer, Evangeline aquifer, Galveston County, Harris County.

This report consists of: (1) Four maps that present data on water-level changes during 1977-82 and 1981-82 in the Chicot and Evangeline aquifers and (2) one set of graphs that present data on the compaction of subsurface materials for 1973-82. During these periods, ground-water pumping decreased in Galveston County and eastern Harris County and increased in northern and western Harris County. (USGS)
W83-00075

SELECTED HYDROGEOLOGIC DATA FROM SOUTHERN SWEET GRASS COUNTY, SOUTH-CENTRAL MONTANA,
Geological Survey, Helena, MT. Water Resources Div.
R. D. Feltis, and Wayne A. Wood.
Available from the OFSS, USGS Box 25425, Fed. Ctr. Denver, CO 80225, Price: $3.25 in paper copy, $4.00 in microfiche. Open-File Report 82-265, February 1982. 12 p, 2 Fig, 1 Plate, 3 Tab.

Descriptors: *Groundwater, *Water quality, *Hydrologic data, *Water wells, Springs, Sites, Well data, Chemical analysis, Physical properties, Trace elements, *Montana, Sweet Grass County.

Selected hydrogeologic data from Sweet Grass County south of the Yellowstone River have been compiled to show baseline ground-water conditions. Included are records from a 1981 onsite inventory of 94 water wells and 30 springs. Chemical analyses of water show the major cation and anion concentrations for 40 wells and 14 springs. Concentrations of 17 trace elements in water from 12 of the wells and 9 of the springs were determined by an argon coupled emission spectrometer. (USGS)
W83-00076

HYDROLOGIC DATA FOR URBAN STORM RUNOFF FROM NINE SITES IN THE DENVER METROPOLITAN AREA, COLORADO,
Geological Survey, Lakewood, CO. Water Resources Div.
J. W. Gibbs.
Available from the OFSS, USGS Box 25425, Fed. Ctr. Denver, CO 80225, Price: $29.50 in paper copy, $7.00 in microfiche. Open-File Report 81-682, 1981. 142 p, 1 Fig, 7 Plates, 84 Tab, 4 Ref.

Descriptors: *Hydrologic data, *Storm runoff, *Rainfall-runoff relationships, *Water quality, Data collections, Urban runoff, Retention, Reservoirs, Model studies, *Colorado, Denver metropolitan area.

Urban storm-runoff data were collected April through September 1980, from nine urbanrunoff sites in the Denver metropolitan area, and are presented in this report. The sites consist of two single-family residential areas, two multi-family residential areas, one commercial area (shopping center), one mixed commercial and multi-family residential area, one native area (open space), and two detention ponds. Precipitation, rainfall-runoff, water-quality (common constituents, nutrients, coliform bacteria, solids, and trace elements) and basin-area data are necessary to use the U.S. Geological Survey's Distributed Routing Rainfall-Runoff Model, Version II. The urban storm-runoff data may be used to characterize runoff pollution loading for various land-use types in Denver and other semi-arid regions. (USGS)
W83-00077

WATER RESOURCES OF THE RINCON AND MESILLA VALLEYS AND ADJACENT AREAS, NEW MEXICO,
Geological Survey, Albuquerque, NM. Water Resources Div.
C. A. Wilson, R. R. White, B. R. Orr, and R. G. Roybal.
New Mexico State Engineer Technical Report 43, 1981. 514 p, 19 Fig, 16 Plates, 14 Tab, 125 Ref.

Descriptors: *Surface-groundwater relations, *Hydrologic data, *Water quality, *Water supply, Water use, Surface irrigation, Irrigation effects, Return flow, Aquifers, Well data, Chemical analysis, *New Mexico, Rincon Valley, Mesilla Valley, Rio Grande.

The Rincon and Mesilla Valleys of New Mexico extend from Caballo Reservoir to El Paso del Norte, west of El Paso, Texas. Water supplies for this area are obtained from the Rio Grande and from the saturated sediments filling the intermontane basins of south-central New Mexico. The two major aquifers are the Santa Fe Group of Miocene to middle Pleistocene age and flood-plain alluvium of late Pleistocene and Holocene age. The flood-plain alluvium is recharged primarily from surface-water infiltration from the Rio Grande, irrigation canals, and irrigated fields. Recharge to the Santa Fe Group occurs primarily from downward infiltration of water from the flood-plain alluvium. Aquifer tests were conducted on 58 wells and test holes. Estimated transmissivities range from 1.3 to 21,100 feet squared per day. Average well yields are 1,050 gallons per minute in the Rincon Valley and 1,500 gallons per minute in the Mesilla Valley. Dissolved-solids concentrations in the flood-plain alluvium of the Rincon and Mesilla Valley are generally greater than 1,000 milligrams per liter. A freshwater zone, with dissolved-solids concentrations less than 1,000 milligrams per liter, underlies this thin, slightly saline zone along much of the Mesilla Valley. (USGS)
W83-00078

HYDROLOGIC DATA FOR EXPERIMENTAL AGRICULTURAL WATERSHEDS IN THE UNITED STATES, 1973,
Agricultural Research Center, Beltsville, MD. Hydrologic Data Lab.
J. B. Burford, J. L. Thurman, and R. T. Roberts.
Agricultural Research Service Miscellaneous Publication No. 1420, July 1982. 408 p, 120 Fig, 300 Tab, 55 Ref.

Descriptors: *Hydrologic data, *Agricultural watersheds, *Precipitation, *Runoff, *Flow discharge, Watersheds, Storm runoff, Air temperature, Rainfall intensity, Hyetographs, Hydrographs.

Selected hydrologic data are presented from 100 watersheds for 1973. Data are included on monthly precipitation and runoff for all the watersheds; annual maximum discharge and maximum volumes of runoff for intervals of 1, 2, 6, and 12 hours and 1, 2, and 8 days for 97 watersheds; daily precipitation for 99 watersheds; mean daily discharge for 100 watersheds; daily maximum and minimum air temperatures for 15 watersheds; and detailed information on one or more selected typical storm events for 88 watersheds. Information on selected storm events includes tabular data for antecedent rainfall and runoff; data on rainfall intensity and runoff for the event and on accumulated depth of rainfall and runoff; description of watershed conditions at the time of the selected events; and plottings of runoff hydrographs and rainfall histograms. For newly established watersheds, descriptions of watershed physical characteristics, instrumentation, land management, and recommended area of application of the results are given, as well as graphs and maps. (Moore-SRC)
W83-00095

HYDROLOGIC DATA FOR THE ALLUVIUM AND TERRACE AQUIFER OF THE BEAVER-NORTH CANADIAN RIVER FROM THE PANHANDLE TO CANTON RESERVOIR, NORTHWESTERN OKLAHOMA,
Geological Survey, Oklahoma City, OK. Water Resources Div.
R. E. Davis, S. C. Christenson, and S. P. Blumer.
Open-File Report 80-159, January 1981. 77 p, 1 Plate, 4 Tab, 3 Ref.

Descriptors: *Data collections, *Groundwater, *Geohydrology, *Aquifers, Water wells, Test holes, Springs, Chemical analysis, Water level, Low flow, *Oklahoma.

The U.S. Geological Survey has collected data on Oklahoma's groundwater resources since 1934. The data in this report were collected as part of a study in cooperation with the Oklahoma Water Resources Board to evaluate the geohydrology of the alluvium and terrace aquifer of the Beaver-North Canadian River in northwestern Oklahoma. The data include records of approximately 900 wells, test-holes, and springs, results of chemical analyses of water from 30 wells tapping the aquifer, monthly water-level measurements for selected wells, and low-flow discharge measurements of the Beaver-North Canadian River and its tributaries. All of the data were collected in the field during the period 1977-79. (USGS)
W83-00110

QUALITY OF SURFACE WATER AT SELECTED SITES IN THE SUWANNEE RIVER BASIN, FLORIDA, 1980,
Geological Survey, Tallahassee, FL. Water Resources Div.
J. E. Coffin.
Available from the OFSS, USGS Box 25425, Fed. Ctr. Denver, CO 80225, Price: $15.00 in paper copy, $3.50 in microfiche. Open-File Report 82-103, 1982. 107 p, 57 Fig, 18 Tab, 16 Ref.

Descriptors: *Water quality, *Surface water, *River basins, Monitoring, Water sampling, Sites, Data collections, Chemical analysis, Hydrologic data, Water analysis, *Florida, Suwannee River basin.

This report presents the results of analyses of water-quality samples collected from 14 surface-water sites in the Suwannee River basin in Florida from January through December 1980. The analyses of samples collected routinely included: nutrients, total organic carbon, and 5-day biochemical oxygen demand, bimonthly; and trace metals, annually. The array of constituents sampled was expanded in October 1978 at three of the original nine stations to provide quality-of-water information for streams draining an industrial area: Rocky Creek near Belmont, Hunter Creek near Belmont, and Swift Creek at Facil. Data collected at these three sites now include: major chemical constituents, six times per year: radium-226, two times per year; and trace metals, one time per year. These constituents are determined in addition to nutrients, total organic carbon, and bio-chemical oxygen demand which continue to be analyzed six times per year. All results of analyses of the water-quality samples collected from January through December 1980 remained within, or near, previously measured ranges and water-quality fluctuations were similar to those noted from data collected since 1971. (USGS)
W83-00113

MAP SHOWING THE POTENTIOMETRIC SURFACE OF THE MAGOTHY AQUIFER IN SOUTHERN MARYLAND, SEPTEMBER 1981,
Geological Survey, Annapolis, MD. Water Resources Div.; and Geological Survey, Towson, MD. Water Resources Div.
F. K. Mack, J. C. Wheeler, and S. E. Curtin.
Available from the OFSS, USGS Box 25425, Fed. Ctr. Denver, CO 80225, Price: $1.00 in paper copy, $3.50 in microfiche. Open-File Report 82-257, 1982. 1 Sheet.

Descriptors: *Maps, *Potentiometric level, *Aquifers, *Observation wells, Groundwater level, Coastal plains, *Maryland, Magothy aquifer, Cone of depression.

The map is based on measurements from a network of 83 observation wells cased to the Magothy aquifer. Highest levels of the potentiometric surface, 59 to 60 feet above sea level, were measured near the outcrop-subcrop of the aquifer in topographically high areas of Anne Arundel and Prince Georges Counties. The surface slopes to the southeast to above sea level along much of the western shore of Chesapeake Bay. Three separate, distinct, and extensive cones of depression have developed in the potentiometric surface around the well fields of the city of Annapolis-Broadneck Peninsula area, town of Waldorf, and Chalk Point. Several square miles of each cone are below sea level, and, in some areas at Chalk Point and Waldorf, the cone is 40 to 50 feet below sea level. The network of wells was developed as part of the cooperative program between the U.S. Geological Survey, the Maryland Geological Survey, and the Maryland Energy and Coastal Zone Administration. (USGS)
W83-00115

GEOHYDROLOGY OF THE VALLEY-FILL AQUIFER IN THE SCHENECTADY AREA, SCHENECTADY COUNTY, NEW YORK,
Geological Survey, Albany, NY. Water Resources Div.
G. A. Brown, R. B. Moore, K. I. Mahon, and R. V. Allen.
Available from the OFSS, USGS Box 25425, Fed. Ctr. Denver, CO 80225, Price: $17.00 in paper copy, $3.00 in Microfiche. Open-File Report 82-84, 1981. 6 Sheets, 8 Ref.

Descriptors: *Geologic mapping, *Groundwater, *Aquifers, *Groundwater movement, Aquifer characteristics, Well yield, Permeability, Groundwater level, Land use, Geohydrology, Hydrologic data, *New York, Schenectady County, Soil Permeability.

This report is the fourth in a series of 11 map sets depicting geohydrologic conditions in selected aquifers in upstate New York. Geohydrologic data are compiled on six maps at 1:24,000 scale. Together the maps provide a comprehensive overview of the Schenectady aquifer, the principal aquifer in Schenectady County and the most heavily pumped aquifer in upstate New York. The maps include surficial geology, geologic sections, soil permeability, water-table altitude, aquifer thickness, estimated well yield, and land use. The maps are designed to enable planners to evaluate underground waste-disposal practices that could adversely affect the aquifer. (USGS)
W83-00116

GEOHYDROLOGY OF THE VALLEY-FILL AQUIFER IN THE CORNING AREA, STEUBEN COUNTY, NEW YORK,
Geological Survey, Albany, NY. Water Resources Div.
T. S. Miller, J. L. Belli, and R. V. Allen.
Available from the OFSS, USGS Box 25425, Fed. Ctr. Denver, CO 80225, Price: $21.50 in paper copy, $3.00 in microfiche. Open-File Report 82-85, 1982. 6 Sheets, 9 Ref.

Descriptors: *Geologic mapping, *Groundwater, *Aquifers, *Groundwater movement, Aquifer characteristics, Well yield, Permeability, Groundwater level, Land use, Geohydrology, Hydrologic data, *New York, Steuben County, Soil permeability.

This report is the seventh in a series of 11 map sets depicting geohydrologic conditions in selected aquifers in upstate New York. Geohydrologic data are compiled on six maps at 1:24,000 scale. Together, the maps provide a comprehensive overview of a major valley-fill aquifer in southeastern Steuben County. The maps include surficial geology, geologic sections, water-infiltration potential of soil zone, aquifer thickness, potentiometric-surface elevations, and land use. The valley-fill deposits consist of alluvial silt, sand, and gravel, glacial-outwash (sand and gravel), till, and lacustrine silt and clay. The sand and gravel beds have relatively high permeabilities, whereas the till and silt deposits have relatively low permeabilities. Water-table conditions prevail in unconfined sand and gravel along the valley margin. Artesian conditions are found locally in sand and gravel confined under silt and clay in the middle of the valley. Recharge occurs nearly everywhere on the valley floor, but principally along the margin of the valley, where highly permeable land surface conditions exist, and runoff from the hillsides is concentrated. The use of land overlying the aquifer is a mixture of residential, commercial, agricultural, and industrial uses. (USGS)
W83-00117

WATER RESOURCES DATA FOR NEW YORK, WATER YEAR 1981--VOLUME 3. WESTERN NEW YORK.
Geological Survey, Albany, NY. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as. Water-Data Report NY-81-3, March 1982. 223 p, 5 Fig, 1 Tab.

Descriptors: *Hydrologic data, *Surface water, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Wells, Water level, Data collections, Sites, *New York, Western New York.

Water resources data for the 1981 water year for New York consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels and water quality of ground-water wells. This volume contains records for water discharge at 85 gaging stations, stage only at 14 gaging stations, stage and contents at 6 gaging stations and 2 other lakes and reservoirs, water quality at 15 gaging stations, 4 quality of precipitation stations, and water levels at 19 observation wells. Also included are data for 62 crest-stage and 12 low-flow partial-record stations. Additional water data were collected at various sites not involved in the systematic data-collection program and are published as miscellaneous measurements and analyses. These data together with the data in Volumes 1 and 2 represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State, local, and Federal agencies in New York. (USGS)
W83-00131

WATER RESOURCES DATA FOR NORTH CAROLINA, WATER YEAR 1981.
Geological Survey, Raleigh, NC. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-103432, Price codes: A21 in paper copy, A01 in microfiche. Water-Data Report NC-81-1, March 1982. 465 p, 6 Fig, 2 Tab.

Descriptors: *Hydrologic data, *Surface water, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Wells, Water level, Data collections, Sites, *North Carolina.

Water resources data for the 1981 water year for North Carolina consist of records of stage, discharge, and water quality of streams; stage and contents of lakes and reservoirs; and ground-water levels. This report contains discharge records for 151 gaging stations, stage and contents for 24 lakes and reservoirs and stage only for one lake, water quality for 52 gaging stations and 6 miscellaneous sites, and water levels for 61 observation wells. Additional water data were collected at various sites not involved in the systematic data-collection program and are published as miscellaneous measurements in this report. The collection of water-resources data in North Carolina is a part of the National Water-Data System operated by the U.S. Geological Survey in cooperation with State, municipal, and Federal agencies. (USGS)
W83-00132

SOIL MAPS OF MONTANA,
Montana State Univ., Bozeman. Dept. of Plant and Soil Science.
G. A. Neilson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-108431, Price codes: A02 in paper copy, A01 in microfiche. Montana Water Resources Research Center, Bozeman, MWRRC Report No. 112, December 1980. 7 p, 4 Ref. OWRT A-091-MONT, 14-34-0001-8028.

Descriptors: *Montana, *Soil surveys, *Maps, *Topographic mapping, *Graphical analysis, Soil types, Soil classification, Soil profiles, Soil horizons, Soil management, Soil physical properties, Soil surfaces, Geologic mapping, Mapping, Graphical methods, Mathematical studies, Baseline studies, Environmental effects, Evapotranspiration, Erosion, Consumptive use, Precipitation, Chinook, Computer programs.

A generalized soil map of the State of Montana and associated descriptive text were prepared. The completed color map has a scale of 1:1,000,000, and shows 132 mapping units named as associations of Great Groups of soils. Mapping units were grouped on the basis of soil order, physiography, and climatic regime. A computer-graphic system was successfully developed for retrieval/display of the soil map data, together with other compatible land resource information. Platter-drawn Montana maps show distributions of environmental variables, singularly or in combinations. These variables include: soils; first/last freeze dates; growing season length and precipitation,

annual precipitation; annual snowfall; climax vegetation; geology; potential evapotranspiration; consumptive water use; erosive rains; peak precipitation; strong chinook wind frequency; elevation; summer rainfall probabilities; and land area from LANDSAT remote-sensing imagery. Each map contains 18,060 cells; one cell represents 13.2 sq km. The computer/plotter system is used to delineate areas that are agriculturally/environmentally similar. Plotter-drawn composite maps show statewide distribution of lands with specified characteristics, thereby offering site selection capabilities and the extrapolation of research results. LANDSAT imagery and other published data are readily compatible with this map base. (Zielinski-MAXIMA)
W83-00237

REMOTE SENSING OF WATER RESOURCES ON PACIFIC ISLANDS,
Guam Univ., Agana. Water and Energy Research Inst. of the Western Pacific.
D. N. Contractor.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-108019, Price codes: A02 in paper copy, A01 in microfiche. Completion Report, June, 1982. 15 p, 4 Fig, 5 Tab, 4 Ref,. OWRT A-023-GUAM (2), 14-34-0001-1112.

Descriptors: *Remote sensing, *Pacific islands, *Aerial photography, *Water resources development, Surface water, Tropical regions, Micronesia, *Palau, *Landsat data, Infrared imagery, Satellite technology, Sensors, Telemetry, Land classification, Water supply development.

The value of the Landsat data base for locating additional fresh water resources on remote Pacific islands was assessed, with specific attention given to a classification of land and water resources for Palau. Analysis of the 1975 Landsat image of Palau provided a land-cover classification of Babelthuap, Koror and the neighboring islands, Peleliu, and Anguar. The prominent land-cover features were identified and their areas obtained. Areas having potential value as additional fresh water sources were identified. The larger water resources included the water supply reservoir, the major rivers feeding into Karamado Bay, the Anguar phosphate mines, and the marine lakes in the rock islands. In an attempt to identify small scale features (e.g., groundwater seeps, taro patches), the spectral signature of the fresh water reservoir was used to identify other areas of similar characteristics. The areas brought out by this analysis were: coastline points where groundwater may leave the aquifer; ocean points suggesting submarine fresh water spring locations; and isolated inland fresh water locations. If there are several Landsat picture elements (area coverage: 1.1 acres), the probability of fresh water occurrence may be high; if only one element occurs, the probability will be low. Barring certain factors (cloud cover, resolution), Landsat data obtained over Pacific islands was deemed very useful for locating additional water resources. (Zielinski-MAXIMA)
W83-00262

8. ENGINEERING WORKS

8A. Structures

THE STATISTICS OF EXTREME VALUES AND THE ANALYSES OF FLOODS IN SOUTH AFRICA,
Department of Water Affairs, Pretoria (South Africa). Div. of Hydrology.
For primary bibliographic entry see Field 2E.
W83-00089

PLUMBLINE MONITOR INTERFACE,
Bureau of Reclamation, Denver, CO. Engineering and Research Center.
For primary bibliographic entry see Field 8G.
W83-00094

KIELDER - PLANNING TO MEET THE FUTURE.
Water Services, Vol 86, No 1035, p 213, 214, 216, May, 1982. 4 Fig.

Descriptors: *Reservoir design, *Reservoir construction, *Dam design, *Earth dams, Construction, Weirs, Rivers, Tunnels, Water distribution, Water resources development, Water supply development, Reservoirs, Artificial lakes, *United Kingdom, Kielder reservoir, *Kielder dam.

Construction of a major reservoir at Kielder combined with a network of pipes and tunnels connecting the Tyne, Wear, and Tees was designed to provide water for the industrial Teesside area. The dam is the largest ever constructed in Britain, with the largest pumping station and largest manmade lake. The earth dam is 1.2 km long and 52 m high. It has a 180 m overflow weir and more than 700 recording instruments are buried in the dam to relay information on the state of the structure. The central clay core makes the dam water tight. A hydroelectric generating plant is planned for the main dam. The water transfer system was designed to provide 85% of the North-East region with abundant water to meet population and industrial needs. (Small-FRC)
W83-00207

APPLICATION TO THE DES MOINES RIVER OF MULTIPLE RESERVOIR OPERATING STRATEGIES INCORPORATING SHORT-AND LONG-TERM INFORMATION IN REAL TIME,
Iowa Univ., Iowa City. Inst. of Hydraulic Research.
For primary bibliographic entry see Field 4A.
W83-00248

HIGH PLAINS - OGALLALA AQUIFER STUDY WATER TRANSFER ELEMENT,
Corps of Engineers, Dallas, TX. Southwestern Div.
For primary bibliographic entry see Field 4A.
W83-00312

DRAINAGE AND STRUCTURES.
Public Works, Manual, p B17-B27, 1982.

Descriptors: *Storm sewers, *Drainage engineering, *Drainage systems, *Culverts, *Bridges, Drainage, Surface drainage, Conduits, Bridge design, Highways, Pipes, Flood control, Piles, Erosion control, Water control.

Drainage and subdrainage systems relevant to highway engineering are discussed as means of effectively avoiding flooding and damage to property. Types of pipe suitable for culverts and subdrains, the design of culverts, and the installation and cleaning of culverts are described. Bridges are discussed including galvanized, panel, concrete, bridge protection, bridge cleaning, and inspection vehicles. Paved watercourses, tunnels, and types of piles are also discussed. Surface drainage control can prevent erosion, while proper culvert design can prevent silting and lower the water table when necessary. Product sources are listed for most structures discussed and include bridge flooring, expansion joints, concrete deck protection, bridge bearing pads, bridge railings, bridge forms, cleaning and painting equipment, and mobile scaffolds. (Small-FRC)
W83-00334

SYSTEM MAINTENANCE.
Public Works, Manual, p C68-C74, 1982.

Descriptors: *Maintenance, *Conveyance structures, *Water mains, *Leakage, *Cleaning, Flushing, Cracks, Pipes, Water-carrying capacity, Linings, Water loss, Coatings, Algal control, Weed control, Wells, Reservoirs.

Equipment necessary for water system maintenance is discussed for checking system condition as well as cleaning and making repairs. Detection devices are available for locating mains and valves, and equipment is described for measuring leakage, measuring hydrant discharge, leak locators, and for the repairs of cracks and breaks in pipes. Main capacities are maintained through flushing, hydraulic pressure cleaning, mechanical cleaning, relining existing mains, and determining main hydraulics. Equipment available to assist in installing connections includes tapping machines, service clamps, and aids to the insertion of branches and valves. Maintenance departments also use products for repairing leaks in concrete as well as paints and coatings. Chemicals are generally used for killing algae and weeds in wells and reservoirs, and equipment can be used to dredge reservoirs or restore wells. Sources are given for most of the equipment discussed. (Small-FRC)
W83-00339

8B. Hydraulics

LARGE-SCALE BEDFORMS IN THE PLATTE RIVER DOWNSTREAM FROM GRAND ISLAND, NEBRASKA: STRUCTURE PROCESS, AND RELATIONSHIP TO CHANNEL NARROWING,
Geological Survey, Denver, CO. Water Resources Div.
For primary bibliographic entry see Field 4D.
W83-00111

THE FLOW OF SLURRY FROM A BREACHED TAILINGS DAM,
University of the Witwatersrand, Johannesburg (South Africa). Dept. of Construction Materials.
G. E. Blight, M. J. Robinson, and J. A. C. Diering.
Journal of the South African Institute of Mining and Metallurgy (Johannesburg), Vol 81, No 1, p 1-8, January, 1981. 8 Fig, 7 Ref.

Descriptors: *Mine wastes, *Flow characteristics, *Mathematical models, *Dam failure, *Hydraulic properties, Spoil banks, Strip mine wastes, Slurries, Slime, Hydraulics, Hydrodynamics, Flow discharge, Model studies, Prediction, Forecasting, Dams, Particle size, Physical properties, Viscous flow, Viscosity.

The wall of a tailings dam at Bafokeng failed, with about 3 million cu m of liquified tailings slurry flowing through the wall breach, engulfing a vertical mine shaft, and flowing on down the Kwa-Leragane River valley. The mechanism of the flow of the tailings slurry was examined, and a mathematical model was developed to describe the flow. Predictions based on the model were compared with the flow that actually occurred near the mine shaft following the tailings dam failure. The predictions were found to be of acceptable accuracy. Hence, the proposed analysis for the flow of a slurry appears to provide a realistic model of the process in that it predicts realistic depths of flow. The analysis was developed to enable the safety of surface installations in the vicinity of tailing dams to be examined. For this purpose, the static or stagnant depth of the slurry adjacent to an obstruction is required. The static depth is obtained by the addition of the velocity head to the dynamic flow depth (DFD). In the case considered, the velocity head has a value of about 5 m, which, when added to the DFD, compares favorably with the observed height to which the cladding of the winder house was damaged. Notwithstanding certain assumed uncertainties, it is considered that the analysis described provides a useful additional tool for the tailings - disposal engineer. While useful, it would be difficult to predict slurry flow after River entry since the continuity equation would be complicated by the unknown increase in flow volume. (Zielinski-MAXIMA)
W83-00285

8C. Hydraulic Machinery

LARGE WATER TRANSPORT PUMPS,
C. H. Laux.
Aqua, No 3, p 11-16, 1982. 11 Fig, 9 Ref.

Descriptors: *Pumps, *Water transport, Hydraulic machinery, Design criteria, Pumping, Economic aspects.

Water transport pumps, designed for heavy duty applications such as moving large volumes of water to high altitudes or over long distances, are designed to be compact and easily maintained. Guidelines for selection of water transport pumps are given, knowing the water analysis (clean or corrosive), the available net positive suction head (normally 11-18 m), and driver type. The lower the speed, the larger will be the pump. When low speeds are necessary because of corrosive water or other factors, a booster pump can be less costly than a single large low speed pump. The optimum number of pumps is determined by available space, the need for 1 standby pump for every 3 operating pumps, runout, and power input. Suggestions are given to improve pump life (distributing the head over multiple stages), reducing water hammer (large fly wheels), and minimizing maintenance (horizontally split casings). A formula determines the maximum running speed and specific speed. Usually a single stage pump is cheaper than a 2 stage pump, but it is often heavier, less efficient, and not suitable for sand-carrying or corrosive water. Driver types depend on the availability and strength of the electricity, the size and speed of the driver, and whether or not speed regulation is required. Electricity is commonly used where possible, but steam turbines are good for very large power inputs. Gas turbines, with fast startup and speed regulation, are often used in oil-producing countries. Possible adjustments to compensate for demand fluctuations are a combination of parallel operation of identical pumps driven by two speed motors, variable-speed pumps, combination of a variable-speed booster pump with a constant-speed main pump, combination of parallel and series operation of identical pumps, and combination of constant rate pump with storage reservoirs. (Cassar-FRC)
W83-00206

ASSESSMENT OF LOW HEAD, MICRO HYDROELECTRIC EQUIPMENT FOR USE ON SMALL TROPICAL ISLANDS,
Guam Univ., Agana. Water and Energy Research Inst. of the Western Pacific.
D. N. Contractor, and S. J. Winter.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-108076, Price codes: A02 in paper copy, A01 in microfiche. Technical Report No 33, April, 1982. 8 p, 1 Tab, 3 Ref. OWRT A-024-GUAM(1), 14-34-0001-1112.

Descriptors: *Hydroelectric plants, *Tropical regions, *Estimated costs, *Design criteria, *Feasibility studies, Evaluation, Power plants, Tropical islands, Developing countries, Economic aspects, Cost-benefit analysis, Cost repayment, Electrical equipment, Power head, Flow duration, *Ponape Island.

An investigation was made of two potential sites on an underdeveloped tropical island (Ponape island) for installing a micro-hydroelectric generation unit. The technology for this development already exists and has been proven to be cost-effective in developed countries. Preliminary investigations were made to size candidate units, manufacturers of hydro equipment suitable for installation at these sites were identified, and price quotations were obtained. Daily discharge data for four rivers were used to obtain flow-duration curves. The curves indicated that the hydrologic regimes of the rivers were similar. Hence, the mean line through the curves could be used as a prediction for other watersheds in the same general area. Estimated flow and power-duration curves were developed for each of the two sites. Recommendations for equipment requirements were derived for each site from the power-duration curves. Further study is needed prior to ordering either of the two candidate units identified, including cost estimates for shipping, installation, and for the electric transmission and distribution lines. It was concluded, however, that the findings of this preliminary study show that a micro-hydroelectric generation system installed at either or both of the sites would satisfy electrical needs of a small tropical island in a cost-effective manner. (Zielinski-MAXIMA)
W83-00268

MAINS AND SERVICES.
Public Works, Manual, p C26-C35, 1982.

Descriptors: *Water distribution, *Pipelines, *Conveyance structures, *Water mains, *Pipes, Concrete pipes, Metal pipes, Plastic pipes, Plumbing, Construction joints, Mechanical equipment, Coatings.

Underground pipelines for water distribution and service lines are described. Materials for mains include ductile iron, plastic or thermoplastic, steel, asbestos-cement, and cement. Information is presented on joints, fittings, and coatings. Services are of steel, iron, copper, brass, or plastic. Corporation and curb stops attach to the water mains, and are discussed in terms of service boxes, tunneling and pushing, pipe handling, and pipe cutting. Sources for the equipment discussed are listed to aid the engineer in gathering information about what is a major part of any water system investment. (Small-FRC)
W83-00313

COLLECTION SYSTEMS.
Public Works, Manual, p D2-D10, 1982.

Descriptors: *Sewer systems, *Conveyance structures, *Water mains, *Construction, Concrete pipes, Plastic pipes, Steel pipes, Construction joints, Construction materials, Wastewater facilities, Pipes, Plumbing.

Collection systems, the largest investment in a sewerage system, are discussed, including the piping system, sub-mains, mains, interceptors, and manholes. Specifications for vitrified clay pipe; pipe fittings and specials; pipe manufacturers; and methods of testing, installing, and joining clay pipe are discussed. Gravity flow concrete sewer pipe is discussed, including manufacturers, ASTM specifications, lining materials, coatings, pipe manufacture, build-in-place sewers, joints, and tapping sewers. PVC, ABS, and PE thermoplastic sewer pipes, asbestos-cement pipe, ductile iron pipe, and corrugated pipe are also considered. Equipment related to sewers includes manholes, pipe tools, regulators, and small presurized and vacuum systems. Suppliers are listed for most of the equipment discussed. (Small-FRC)
W83-00338

WATER STORAGE.
Public Works, Manual, p C48-C56, 1982.

Descriptors: *Water storage, *Standpipes, *Storage tanks, *Reservoirs, *Water distribution, Construction materials, Design criteria, Coatings, Prestressed concrete, Water tanks, Storage, Reinforced concrete, Wells, Reservoir linings, Reservoir storage, Reservoir evaporation, Mechanical equipment.

Distribution system storage to supply peak loads and to provide a reserve for fire fighting is discussed, and elevated and ground storage systems are described. Elevated tanks and standpipes include circular steel tanks, tubular columns, double ellipsoidal tanks, and hemispherical bottom tanks. Elements of tank design include tank bottoms, towers, risers, and multiple-use tanks. Coating systems are important especially for the protection of steel tanks, and cathodic protection can be used to prevent rust, erosion, and pitting. Reinforced concrete tanks and prestressed tanks are used. Equipment for developing groundwater sources includes vertical wells, gravel-wall wells, well screens, horizontal wells, and sand removers. Aspects of surface reservoirs include natural liners, rigid liners, flexible membrane liners, reservoir evaporation retardants and covers, and collapsible tanks. Sources are listed for all of the equipment discussed. (Small-FRC)
W83-00340

8G. Materials

PLASTICS GIVE 20 YEARS LIFE-SPAN - WITH VIRTUALLY ZERO MAINTENANCE.
Water and Waste Treatment, Vol 25, No 5, p 28-29, May, 1982.

Descriptors: *Plastics, *Materials engineering, Polymers, Storage tanks, Water tanks, Holding tanks, Settling tanks, Construction materials, Clarifiers, Wastewater treatment, Water treatment facilities.

Polypropylene and composites of Polypropylene/GRP and UPVC/GRP have withstood the tests of time and are most useful as building materials for tanks utilized in the water and wastewater treatment industries. The all polypropylene tank is one of the lowest cost tanks based on price per gallon. Tanks up to 50,000 gallons are reinforced with an external polyester resin glass fiber laminate. These types of tanks can be engineered to British Standard 4494:1973. When purchasing a plastic vessel, it is important to make certain the supplier can construct vessels in a variety of materials. Some companies offering full design facilities offer long term serviceability on polypropylene and GRP reinforced polypropylene tanks. Most vessels have a design life of 12-20 years. Thermoplastic GRP reinforced vessels usually offer a built-in test facility. In the water and wastewater treatment industries, these plastics are used to store reagents and very pure water for critical applications. Tanks of these plastics prove very economical and can be fitted with integral agitator bridges. Polypropylene is being used in settling tanks, clarifiers, mixing tanks, gas scrubbers, salt saturation units, and vessel intervals. (Geiger-FRC)
W83-00008

PLUMBLINE MONITOR INTERFACE,
Bureau of Reclamation, Denver, CO. Engineering and Research Center.
E. Campbell.
Report GR-81-15, December 1981, 10 p, 3 Fig.

Descriptors: *Dam safety, *Monitoring, *Plumblines, Safety, Dam stability, Sensors, Computers.

Various devices have been developed to determine movement of dams as a part of the Safety of Dams Program. One such device is a plumbline to be hung near the top of a vertical shaft within a dam. At the bottom of the shaft the movement of the plumbline can be measured, but reading by maintenance personnel on an intermittent basis does not render accurate or consitent data. A continuous reading, computer compatible, plumbline monitoring device is being developed. The plumbline position is sensed by a Kaman Model KD 2612 noncontacting, two-channel measuring system. The position data is transformed into two bipolar dc voltage outputs. An electronic interface was developed to convert the bipolar variable dc signal level to appropriate TTL (transistor-transis-tor logic) drive pulses for actuating a two axis stepper motor drive system - for an X-Y translation table. Although the interface was designed for this specific purpose, the principle of operation would be useful in any system requiring signal conversion of this type. (Moore-SRC)
W83-00094

CATHODIC PROTECTION OF WATER MAINS,
East Bay Municipal Utility District, Oakland, CA.
A. E. Westerback.
Public Works, Vol 113, No 4, p 49-53, April, 1982. 6 Fig, 2 Tab, 4 Ref.

Descriptors: *Water mains, *Corrosion control, Pipes, Steel, Maintenance, Pipelines, Conveyance structures.

Cathodic protection, which involves replacing electrons to a metal structure at a rate higher than they are lost, is the most effective means available to control exterior corrosion of metallic pipelines. There are two methods for achieving cathodic protection. Sacrificial anode or galvanic anode cathodic protection is a process in which the steel part to be protected is connected to a suitably sized piece of metal more active than steel. The more active metal corrodes at an accelerated rate, protecting the steel. The second method, impressed

current cathodic protection, involves rectifying alternating current to direct current and impressing this current from a buried anode to the pipe. This method is practical for treatment of large diameter, poorly coated pipelines where the current demand is too high to be supplied by galvanic anodes. The East Bay Municipal Utility District in Oakland, California, has successfully used impressed current cathodic protection for its pipelines since the early 1930's. The use of sacrificial anode cathodic protection of pipelines by the District since 1969 also appears to be very successful in controlling corrosion. A cost-benefit study indicated an overall benefit to cost ratio of about 6 to 1. While sacrificial anode cathodic protection is relatively harmless to foreign pipelines and can be only beneficial to a pipeline, impressed current cathodic protection can cause corrosion damage to metallic pipes if it is not used properly. Impressed current corrosion protection should be installed only under the direction of a corrosion control engineering expert, as it can lead to corrosion damage to metallic pipe which may be located between the anode bed of the pipeline. (Carroll-FRC)
W83-00175

INTENSIVE FLOW MONITORING--COST-EFFECTIVENESS WITH A QUALITY EDGE,
Thomas (Frank A.) and Associates, Inc., Willoughby, OH.
For primary bibliographic entry see Field 5G.
W83-00200

A NEW METHOD OF LEAK DETECTION IN DISTRIBUTION SYSTEMS UNDER PRESSURE: ACOUSTIC CORRELATION,
Compagnie Generale des Eaux, Paris (France).
P. Arnac.
Aqua, No 3, p 410-417, 1982. 13 Fig, 1 Tab, 14 Ref.

Descriptors: *Leakage, *Acoustics, *Measuring instruments, Water distribution, Noise, Water conveyance, Water loss.

The acoustic correlation method has been used in France to detect leaks in water distribution systems since 1978. The conventional acoustic method works well under most circumstances, but leaks in noisy environment and leaks deeper than 2 meters may be very difficult to locate. In addition, leak noises may be transferred some distance from their actual location. The acoustic correlation method uses 3 leak noise characteristics (production, progagation, and permanence in time). The theoretical equations of the underlying principles of acoustic correlation are given. Equipment consists of the mobile equipment (2 each of sensors, amplifiers, links between sensors and processing unit) and the equipment inside a vehicle (signal filters, amplifiers, correlator, visualizing equipment, and post computer). The correlator is the heart of the apparatus. Depending on the correlator, a reach up to 260 m can be inspected with accuracy. Generally the distance between sensors is 100-200 m. The correlation method is superior to the conventional method in many cases, but the two methods can be used together to cover most situations. (Cassar-FRC)
W83-00205

METERING, MONITORING AND QUALITY CONTROL.
Public Works, Manual, p C56-C68, 1982.

Descriptors: *Water metering, *User charges, *Water measurement, *Laboratory equipment, *Monitoring, *Process control, Water sampling, Current meters, Water costs, Gages, Remote control, Remote sensing, Colorimetry, Photometry, Hydrogen ion concentration, Turbidity, Conductivity.

Metering is discussed as the basis for determining equitable customer charges, and monitoring and quality control are considered as aspects of controlling the treatment process. Displacement meters, multi-jet meters, current meters, and compound meters are available as well as aids to meter testing and repair, updating old meters, and remote meter reading. Mainline meters are primarily flow meters, and various indicator-recorders are available. Remote control involves telemetering systems including electric, electronic, and pneumatic. Sensors for automatic systems and transmission and reception equipment are used. Laboratory equipment includes visual colorimetric tests, photometric instruments, pH meters, turbidity measurers, and conductivity instruments. Instruments are also needed for microbiological analysis. Instruments for process control include various monitors including turbidity monitors and automatic samplers. Sources are given for most of the equipment discussed. (Small-FRC)
W83-00336

8I. Fisheries Engineering

EVALUATION OF LIMNOLOGICAL PARAMETERS AS RELATED TO THE SUCCESS OF MYSIS RELICTA INTRODUCTIONS,
Wyoming Univ., Laramie. Water Resources, Research Inst.
J. J. Grabowski, and J. Ahern.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-108589, Price codes: A09 in paper copy, A01 in microfiche. Water Resources Series No 85, May, 1982. 164 p, 21 Fig, 10 Tab, 110 Ref, 3 Append. OWRT A-031-WYO(1), 14-34-0001-1154.

Descriptors: *Limnology, *Lake restoration, *Shrimp, *Fish populations, *Feasibility studies, Lake morphology, Prediction, Lake morphometry, Lake stages, Lake fisheries, Lakes, Trout, Fish management, Fisheries, Lake fisheries, Water quality, Water quality control.

A predictive tool was developed to aid fishery managers in determining whether opossum shrimp (Mysis relicta) should be introduced in montane lakes to increase lake trout production. A comparative was undertaken during 1981 to determine the impact of introducing the shrimp to three subalpine Wyoming lakes on the lake ecosystems. Biological, chemical, and physical parameters were monitored during the course of study. Further, the general life history characteristics of the introduced shrimp populations were analyzed relative to the limnological data. The introduced shrimp populations were found to be strongly influenced by ambient water quality and lake productivity. The predictive cold-water fisheries management tool was derived from the study results and pertinent literature information. This tool consists of nine parameters: lake tro phic status, plankton abundance/composition, resident fish species, lake bathymetry, water temperatues, metalimnion thermal gradient, dissolved oxygen level, acidity levels, and dissolved ion content. These parameters should be considered or measured in relation to one another by the fisheries manager before shrimp introduction. (Zielinski-MAXIMA)
W83-00254

SOME VARIATIONS IN DISTRIBUTION OF FISHES IN LARGE MAINSTREAM RESERVOIRS ASSOCIATED WITH ARTIFICIAL COVER,
Kentucky Water Resources Research Inst., Lexington.
D. W. Johnson, and E. M. Choinski.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-108597, Price codes: A04 in paper copy, A01 in microfiche. Research Report No 135, July, 1982. 56 p, 17 Fig, 6 Tab, 47 Ref, 1 Append. OWRT A-080-KY(1), 14-34-0001-0119/1119.

Descriptors: *Fish populations, *Reservoirs, *Fish attractants, *Fish behavior, *Fish migration, Fish control agents, Fish management, Submerged plants, Aquatic populations, Aquatic environment, Fish establishment, Fish harvest, Fish farming, *Artificial cover, Sport fishing.

The influence of submerged artificial cover afforded by brush piles on fish populations in two lakes (Kentucky Lake and Lake Barkley) was investigated. Both mature and larval fish were sampled from deep and shallow lake sites, with/without artificial cover. Highest densities of mature crappie, black bass, and sanger fish critical to the Tennessee Vabley recreation industry, were found adjacent to deeply placed (greater than 4 meters) attractors. Larval crappie and minnows were most concentrated at shallow brush piles. Installation of natural materials (brush attractors) was more effective in aggregating sport fish than industrial products (tires). Adult/larvae shad did not congregate at attractor sites. Tagging studies indicated that most bass and crappie do not move far from winter to spring spawning substrate and summer cover. The results obtained in this investigation support the continuation of artificial cover installation and water level management procedures which will provide high and stable fish populations through spring spawning and early development. Installation of suitable cover in reservoir littoral zones and use of high and stable water levels flooding natural vegetation enhance reproductive success and survival of sport fish populations. (Zielinski-MAXIMA)
W83-00255

INSTREAM SALMONID HABITAT EXCLUSION BY ICE-COVER,
Wyoming Univ., Laramie. Water Resources Research Inst.
L. S. Johnson, D. L. Wichers, T. A. Wesche, and J. A. Gore.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-108613, Price codes: A03 in paper copy, A01 in microfiche. Water Resources Series No 84, May, 1982. 29 p, 4 Fig, 4 Tab, 19 Ref. OWRT B-038-WYO, 14-34-0001-8130.

Descriptors: *Aquatic habitats, *Ice cover, *Prediction, *Mathematical equations, *Fish populations, Fish, Habitats, Trout, Environment, Instream flow, Salmon, Linear programming, Regression analysis, Mathematical studies, Stream fisheries, Management planning, *Wyoming, Wagonhound Creek.

Research was conducted on a small Wyoming foothills stream (Wagonhound Creek) in an attempt to develop a method for predicting the effect of winter ice-cover on the habitat available to a brown trout population. Predictive equations were developed relating the percent of the habitat excluded to days from the winter solstice, degree days of frost, mean water velocity, and mean effective water depth, inclusively. The equations represented the degree of habitant excluded from each of three areas (riffle, run, and pool) at the measurement site, and were solved using multiple linear regression analyses of ice cover. The resultant predictions accurately reflected the conditions on the study stream. While winter instream flow requirements are nebulous, stream managers can make habitat available on regulated streams by estimating what areas are the most critical and how much of the habitat needs to be made available. Knowledge of habitat preferenda at other seasons and the relative stream size would aid subjective judgements concerning the amount of habitat needed. The reported method could be of value to resource managers in determining winter instream flows to maintain trout habitat. (Zielinski-MAXIMA)
W83-00257

PRODUCTION OF REPRODUCTIVELY LIMITED GRASS CARP FOR BIOLOGICAL CONTROL OF AQUATIC WEEDS - PHASE II,
Auburn Univ., AL. Dept. of Fisheries and Allied Aquacultures.
For primary bibliographic entry see Field 4A.
W83-00272

10. SCIENTIFIC AND TECHNICAL INFORMATION

10D. Specialized Information Center Services

EFFECTIVE GRAPHICAL DISPLAY OF WATER RESOURCE PLANNING INFORMATION FOR DECISION MAKERS, VOLUME I,
Gates (W. E.) and Associates, Inc., Batavia, OH.
R. M. Males.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-109827, Price codes: A06 in paper copy, A01 in microfiche. Final Report, May, 1982. 101 p, 29 Fig, 3 Tab, 17 Ref. OWRT C-90131-C(9461)(1), 14-34-0001-9461.

Descriptors: *Graphical methods, *Water resources development, *Management planning, *Decision making, *Information exchange, Graphical analysis, Mathematical studies, Water supply development, Water management, Administrative decision making, Information systems, Technology transfer, Communication.

The use of graphic communication techniques was investigated as a potential mechanism for responding to the problems of information transfer in water resources planning. It was expected that well-developed technologies for graphic display, clear information transfer points, and types of data could be found in order to test the application of the graphic techniques to the data types. This was not the case. It was determined that understanding is not only central to improved decision-making, but it is also central to the development of graphical display techniques themselves. The need for communications, understanding, the current nature of the planning process, and the nature of decision makers, relative to graphics use, were all explored. It is requisite that technologists become sensitized to better observe graphic communications. As a follow-on to this, and with the identified problems in mind, the basic graphic techniques and problems are presented (e.g., basic chart types, 3-dimensional treatments, maps, multi-variate techniques), followed by a portfolio of techniques relative to charts. Following the development of this general pictorial display, a water resources portfolio is developed and elaborated, demonstrating various graphical examples (e.g., frontal storm patterns, alkalinity qualigrams, stream discharge maps, environmental impact matrix). (Zielinski-MAXIMA)
W83-00273

EFFECTIVE GRAPHICAL DISPLAY OF WATER RESOURCES PLANNING INFORMATION FOR DECISION MAKERS, VOLUME II,
Gates (W. E.) and Associates, Inc., Batavia, OH.
R. M. Males.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-109835, Price codes: A05 in paper copy, A01 in microfiche. Final Report, May, 1982. 83 p, 11 Fig, 18 Ref, 4 Append. OWRT C-90131-C(9461)(2), 14-34-0001-9461.

Descriptors: *Graphical methods, *Water resources development, *Management planning, *Decision making, *Information exchange, Graphical analysis, Mathematical studies, Water supply development, Water management, Administrative decisions, Information systems, Technology transfer, Communication.

The use of graphic communication techniques was investigated as a potential mechanism for responding to the problems of information transfer in water resources planning. This second volume of this 2-volume report presents information concerning the conceptual and theoretical basis of the overall study. Guidelines and techniques were developed for enhancing graphic literacy, representing a means for enhancement in knowledge and understanding of the uses and methods of communication. The guidelines and techniques are presented in the format of 'frames' (single pages that use a combination of charts, maps, and text) to explore and demonstrate concepts related to the proper use of graphics. The techniques and guidelines were developed through investigation of the uses and techniques of graphic information in other disciplines, and a review of example graphic presentation in the water resources field. The frames are designed to be used as training and educational aids to enhance graphic literacy. Material relating to conceptual and theoretical issues of information transfer and decision making in water resources planning is also included. The basic information assembled on graphic techniques and graphic literacy is presented in the first volume of this 2-volume report. The topic of data display by graphic methods as a potential solution to the information transfer problem is frequently suggested. (Zielinski-MAXIMA)
W83-00274

HAZARDOUS WASTE TECHNOLOGY TRANSFER ASSESSMENT,
Pennsylvania State Univ., University Park. Inst. for Research on Land and Water Resources.
For primary bibliographic entry see Field 5E.
W83-00276

10F. Preparation Of Reviews

GUIDELINES FOR SURFACE WATER QUALITY: VOL 1: INORGANIC CHEMICAL SUBSTANCES: COPPER,
Department of the Environment, Ottawa (Ontario). Inland Waters Directorite.
For primary bibliographic entry see Field 5G.
W83-00079

WATER RECLAMATION AND REUSE,
Alberta Univ., Edmonton. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5D.
W83-00163

PULP AND PAPER EFFLUENT MANAGEMENT,
Tufts Univ., Medford, MA.; and National Council for Air and Stream Improvement, Inc., Medford, MA.
For primary bibliographic entry see Field 5D.
W83-00164

LAW,
Virginia Water Resources Center, Blacksburg.
For primary bibliographic entry see Field 6E.
W83-00165

WATER CHARACTERISTICS,
Construction Engineering Research Lab. (Army), Champaign, IL.
For primary bibliographic entry see Field 5B.
W83-00169

HO: FOR REESE RIVER NATURAL RESOURCES OF THE TOIYABE-TOQUIMA HIGHLANDS, CENTRAL NEVADA,
Nevada Univ. System, Reno. Desert Research Inst.
For primary bibliographic entry see Field 6B.
W83-00253

ACIDIC PRECIPITATION AND ITS CONSEQUENCES FOR AQUATIC ECOSYSTEMS: A REVIEW,
Columbia National Fishery Research Lab., MD.
For primary bibliographic entry see Field 5C.
W83-00331

SUBJECT INDEX

2

The Fate of 2,4,6-Trichlorophenol in an Aquatic Continuous-Flow System,
W83-00332 5B

208 PROGRAM

Case Study Analyses of 208 Program Effectiveness in Improving Regional Water Resources Management,
W83-00240 6B

ABSORPTION

Nitrogen Metabolism in Lake Kizaki, Japan I. Ammonium and Nitrate Uptake by Phytoplankton,
W83-00344 2H

ACID MINE DRAINAGE

The Laurel Run Acid Mine Drainage Renovation Demonstration Facility: An Evaluation,
W83-00258 5G

Sludge Disposal from Acid Mine Drainage Treatment,
W83-00298 5E

Stratigaphic Diatom and Chemical Evidence for Acid Strip-Mine Lake Recovery,
W83-00329 2H

ACID RAIN

An Overview of Acid Rain Monitoring Activities in North America,
W83-00189 5C

Lake Restoration Technology Transfer Assessment,
W83-00215 5G

Acidic Precipitation and Its Consequences for Aquatic Ecosystems: A Review,
W83-00331 5C

ACIDIC WATER

Induction of High Phosphatase Activity by Aluminum in Acid Lakes,
W83-00029 5B

Characterization of Acid Phosphatases in the Acidified Lake Gardsjon, Sweden,
W83-00050 5C

An Evaluation of the Recovery of Adirondack Acid Lakes by Chemical Manipulation,
W83-00245 5G

ACOUSTICS

A New Method of Leak Detection in Distribution Systems Under Pressure: Acoustic Correlation,
W83-00205 8G

ACTIVATED CARBON

Adsorption of Toxic and Carcinogenic Compounds from Water,
W83-00171 5F

New Technology for Drinking Water Treatment,
W83-00198 5F

ACTIVATED SLUDGE PROCESS

The Use of Oxygen to Uprate the Treatment Capacity of a Conventional Surface-Aeration Plant at Holdenhurst (Bournemouth) Sewage Treatment Works,
W83-00133 5D

Adenosine Triphosphate as a Control Parameter for Activated Sludge Processes,
W83-00149 5D

Effect of Activated Sludge Operational Conditions on Sludge Thickening Characteristics,
W83-00179 5D

Effect of a Bacterial Culture Product on Biological Kinetics,
W83-00212 5D

Cause of Inefficient Solids Separation in the Activated Sludge Process,
W83-00232 5D

Secondary Treatment.
W83-00325 5D

The Influence of Process Parameters on the Removal of Heavy Metals in Activated Sludge,
W83-00327 5D

ADDITIVES

Development of New Chemical Additives and Treatments for Scale Control in Saline Water Evaporators,
W83-00222 3A

ADENOSINE TRIPHOSPHATE

Adenosine Triphosphate as a Control Parameter for Activated Sludge Processes,
W83-00149 5D

ADIRONDACKS

An Evaluation of the Recovery of Adirondack Acid Lakes by Chemical Manipulation,
W83-00245 5G

ADMINISTRATION

Control Operations and Maintenance Services.
W83-00157 5D

ADSORPTION

Adsorption of PAH to Aquatic Humus,
W83-00038 5B

Association Studies of Polybrominated Biphenyls in Aquatic Systems,
W83-00160 5B

ADVANCED WASTEWATER TREATMENT

High-Quality Trickling Filter Effluent Without Tertiary Treatment,
W83-00142 5D

Advanced Treatment.
W83-00151 5D

Advanced Biological Treatment to Achieve Nutrient Removal,
W83-00349 5D

AERATED LAGOONS

Algal Concentration and Species Composition in Experimental Maturation Ponds with Effects of Aeration and Recirculation,
W83-00284 5D

AERATION

Dissolved Organic Carbon and UV-Absorption in a Polluted Lowland Brook-Pond System,
W83-00024 5G

The Use of Oxygen to Uprate the Treatment Capacity of a Conventional Surface-Aeration Plant at Holdenhurst (Bournemouth) Sewage Treatment Works,
W83-00133 5D

Water Quality Simulation of Wahiawa Reservoir, O'Ahu, Hawaii,
W83-00281 5G

Secondary Treatment.
W83-00325 5D

AERIAL PHOTOGRAPHY

Remote Sensing of Water Resources on Pacific Islands,
W83-00262 7C

AEROBIC CONDITIONS

Aerobic Degradation of Diuron by Aquatic Microorganisms,
W83-00002 5B

AEROSOLS

Acidic Precipitation and Its Consequences for Aquatic Ecosystems: A Review,
W83-00331 5C

AGRICULTURAL HYDROLOGY

Efficient Use of Water for Irrigation in the Upper Midwest,
W83-00242 3F

AGRICULTURAL WATERSHEDS

Hydrologic Data for Experimental Agricultural Watersheds in the United States, 1973,
W83-00095 7C

Water-Quality Assessment of Steiner Branch Basin, Lafayette County, Wisconsin,
W83-00123 4A

AGRICULTURE

The Ogallala--Half Full or Half Empty.,
W83-00017 6D

Use of Rainfall Simulators to Determine Parameters for Erosion Prediction,
W83-00102 2J

AGRONOMIC CROPS

Water-Use Production Functions of Selected Agronomic Crops in Northwestern New Mexico, Phase I,
W83-00235 3F

AIR FLOTATION

Textile Industry Wastewater Treatment by Air Flotation,
W83-00080 5D

AIR POLLUTION EFFECTS

Acidic Precipitation and Its Consequences for Aquatic Ecosystems: A Review,
W83-00331 5C

ALASKA

Finite Element Glacier Dynamics Model Applied to Columbia Glacier, Alaska,
W83-00118 2C

Continuity Equation Model of the Predicted Drastic Retreat of Columbia Glacier, Alaska,
W83-00119 2C

Treatment of Oily Wastewaters from Onshore Operations,
W83-00319 5D

ALBERTA

Paleolimnology of Lake Isle, Alberta, Canada (Including Sediment Chemistry, Pigments and Diatom Stratigraphy),
W83-00316 2H

ALGAE

Metal Binding Capacity in Relation to Hydrology and Algal Periodicity in Tjeukemeer, the Netherlands,
W83-00039 5B

Phytoplankton Contribution to Alkaline Phosphatase Activity,
W83-00041 2H

The Recent Histories of Three Canadian Shield Lakes: A Paleolimnological Experiment,
W83-00042 5C

Preliminary Studies on the Treatment of Canning Factory Effluent with an Integrated Bacterial-Algal-Fish System,
W83-00317 5D

ALGAL CONTROL

Algae Removal by Induced Air Flotation,
W83-00277 5G

ALGAL GROWTH

Algal Concentration and Species Composition in Experimental Maturation Ponds with Effects of Aeration and Recirculation,
W83-00284 5D

The Occurrence of a Fungal Parasite on a Tetraselmis (Prasinophyceae) Species,
W83-00288 5C

ALGORITHMS
Evaluation and Control of Sidestreams Generated in Publicly Owned Treatment Works,
W83-00291 5D

ALIPHATIC HYDROCARBONS
Microorganisms Capable of Degrading Refractory Hydrocarbons in Ohio Waters,
W83-00219 5B

ALKALINITY
High pH Stabilization of Wastewater Sludge Using Chemical Softening Wastes From Water Treatment,
W83-00243 5D

ALTERNATIVE PLANNING
An Alternative to the Peripheral Canal,
W83-00193 6G

ALUM
Rapid-Mix Design for Mechanisms of Alum Coagulation,
W83-00170 5F

ALUMINUM
Induction of High Phosphatase Activity by Aluminum in Acid Lakes,
W83-00029 5B

ALUMINUM SULFATE
Control of Lake Phosphorus with Aluminum Sulfate: Dose Determination and Application Techniques,
W83-00006 5C

AMINO ACIDS
The Aerobic Mineralization of Amino Acids in the Saline Lake Grevelingen and the Freshwater Haringvliet Basin (The Netherlands),
W83-00178 5C

AMMONIA
Accuracy of Determination of Ammoniacal Nitrogen in River Waters: Analytical Quality Control in the Harmonised Monitoring Scheme.
W83-00196 5A

AMMONIUM
Nitrogen Metabolism in Lake Kizaki, Japan. III. Active Nitrification in Early Summer,
W83-00040 2H

Nitrogen Metabolism in Lake Kizaki, Japan I. Ammonium and Nitrate Uptake by Phytoplankton,
W83-00344 2H

ANAEROBIC DIGESTION
Investigations on Cellulose Biodegradation in Activated Sludge Plants,
W83-00013 5D

A Simulation Study on the Operation of Laboratory Scale Anaerobic Digesters,
W83-00138 5D

Fixed-Film Biological Processes,
W83-00191 5D

Digester Control Pays Dividends,
W83-00192 5D

APPLICATION RATES
Land Application of Municipal Sludge with Regard to Cropping Systems and Pollution Potential,
W83-00233 5E

Water Saving Techniques,
W83-00309 3F

AQUATIC BACTERIA
Microorganisms Capable of Degrading Refractory Hydrocarbons in Ohio Waters,
W83-00219 5B

AQUATIC FUNGI
Microorganisms Capable of Degrading Refractory Hydrocarbons in Ohio Waters,
W83-00219 5B

The Occurrence of a Fungal Parasite on a Tetraselmis (Prasinophyceae) Species,
W83-00288 5C

AQUATIC HABITATS
Instream Salmonid Habitat Exclusion by Ice-Cover,
W83-00257 8I

Acidic Precipitation and Its Consequences for Aquatic Ecosystems: A Review,
W83-00331 5C

AQUATIC MICROCOSMS
Heavy Metal Interactions and Dynamics in Simulated Naugatuck River Microcosms,
W83-00214 5B

AQUATIC PLANTS
The Structure and Some Recent Changes of the Zoobenthic Community in the Ermatinger Becken, A Shallow Littoral Part of Lake Constance,
W83-00036 2H

Storage of Carbon and Transport of Oxygen in River Macrophytes: Mass-Balance, and the Measurement of Primary Productivity in Rivers,
W83-00051 5B

An Integrated Study on Littoral and Pelagic Primary Production in a Southern African Coastal Lake,
W83-00053 5C

Algae Removal by Induced Air Flotation,
W83-00277 5G

AQUATIC WEED CONTROL
Aquatic Weed Control with Endothall in a Salt River Project Canal,
W83-00166 4A

Production of Reproductively Limited Grass Carp for Biological Control of Aquatic Weeds - Phase II,
W83-00272 4A

The Ecological Effects of 2-Methylthiotriazine Herbicides used for Aquatic Weed Control in Navigable Canals, II. Effects on Macroinvertebrate Fauna, and General Discussion,
W83-00343 5C

AQUIFER CHARACTERISTICS
Geohydrology of Southwestern Kansas,
W83-00059 7C

The Hydrothermal System in Southern Grass Valley, Pershing County, Nevada,
W83-00060 4B

Summary Appraisals of the Nation's Ground-Water Resources--New England Region,
W83-00120 4B

Estimated Effects of Projected Ground-Water With-Drawals on Movement of the Saltwater Front in the Floridan Aquifer, 1976-2000, West-Central Florida,
W83-00130 4B

A Preliminary Study of Natural Aquifer Discharge of Guam,
W83-00271 5B

AQUIFER MANAGEMENT
The Ogallala--Half Full or Half Empty.,
W83-00017 6D

High Plains-Ogallala Aquifer Study, New Mexico -- Economic Impacts,
W83-00308 6B

AQUIFER SYSTEMS
High Plains-Ogallala Aquifer Study, New Mexico -- Economic Impacts,
W83-00308 6B

AQUIFERS
Geohydrology of the Valley-Fill Aquifer in the South Fallsburgh-Woodbourne Area, Sullivan County, New York,
W83-00069 7C

Approximately Water-Level Changes in Wells in the Chicot and Evangeline Aquifers 1977-82 and 1981-82, and Measured Compaction 1973-82, in the Houston-Galveston Region, Texas,
W83-00075 7C

Applications of Digital Modeling for Evaluating the Ground-Water Resources of the '2,000-Foot' Sand of the Baton Rouge Area, Louisiana,
W83-00109 4B

Hydrologic Data for the Alluvium and Terrace Aquifer of the Beaver-North Canadian River from the Panhandle to Canton Reservoir, Northwestern Oklahoma,
W83-00110 7C

Map Showing the Potentiometric Surface of the Magothy Aquifer in Southern Maryland, September 1981,
W83-00115 7C

Geohydrology of the Valley-Fill Aquifer in the Schenectady Area, Schenectady County, New York,
W83-00116 7C

Geohydrology of the Valley-Fill Aquifer in the Corning Area, Steuben County, New York,
W83-00117 7C

Designation of Principal Water-Supply Aquifers in Minnesota,
W83-00125 2F

High Plains - Ogallala Aquifer Study Water Transfer Element,
W83-00312 4A

AREAL PRECIPITATION
The Analyses of Areal Rainfall Using Multi-Quadric Surfaces,
W83-00088 2B

ARGENTINA
A Principal Components Analysis of the Phytoplankton from a Pond in the Parana River Valley, Argentina,
W83-00022 5C

ARID-ZONE HYDROLOGY
Social and Political Aspects of Drought,
W83-00186 6B

ARIZONA
The USLE Rainfall Factor for Southwestern U. S. Rangelands,
W83-00098 4D

Sediment Yield from Small Semiarid Rangeland Watersheds,
W83-00105 4D

Application of Remote Sensing in Evaluating Floodwater Farming on the Papago Indian Reservation,
W83-00230 3F

Angora Goats for Conversion of Arizona Chaparral: Early Results,
W83-00299 3B

Stream Water Nutrient Changes Associated with the Conversion of Arizona Chaparral,
W83-00300 5B

Runoff and Sedimentation Potentials Influenced by Litter and Slope on a Chaparral Community in Central Arizona,
W83-00301 4D

Water Yield Changes Resulting from Treatment of Arizona Chaparral,
W83-00303 3B

ARKANSAS
Report of the Annual Yield of the Arkansas River Basin for the Arkansas River Basin Compact, Arkansas--Oklahoma, 1980 Water Year,
W83-00063 4A

ARKANSAS RIVER BASIN
Report of the Annual Yield of the Arkansas River Basin for the Arkansas River Basin Compact, Arkansas--Oklahoma, 1980 Water Year,
W83-00063 4A

AROMATIC COMPOUNDS
Adsorption of PAH to Aquatic Humus,
W83-00038 5B

ARTIFICIAL COVER
Some Variations in Distribution of Fishes in Large Mainstream Reservoirs Associated with Artificial Cover,
W83-00255 8I

ARTIFICIAL LAKES
Correlation of Rotifer Associations in a Chain of Lakes Fed by Reclaimed Sewage,
W83-00023 5G

Applicability of Phosphorus Budget Models to Southern African Man-Made Lakes,
W83-00025 5C

ARTIFICIAL PRECIPITATION
The Toxicology of Silver Iodide in Relation to its use as a Cloud Seeding Agent,
W83-00084 2B

ATOMIC ABSORPTION SPECTROPHOTOMETRY
Determination of Boron in River Water with Flameless Atomic Absorption Spectrometry (Graphite Furnace Technique),
W83-00047 5A

AUSTRALIA
Daily Chemical Variability of Domestic Septic Tank Effluent,
W83-00328 5D

AUTOMATION
Instrumental Methods of Monitoring and Control of Water and Wastewater Treatment Processes,
W83-00314 5F

BACTERIA
Distribution of Denitrifying Bacteria and its Controlling Factors in Freshwater Environments,
W83-00018 5C

Limnological Investigations of a Mountain Spring Pond in the Swiss National Park,
W83-00034 2H

Nitrogen Metabolism in Lake Kizaki, Japan. III. Active Nitrification in Early Summer,
W83-00040 2H

Phytoplankton Contribution to Alkaline Phosphatase Activity,
W83-00041 2H

The Sediments of the New Artificial Lake Bostalsee (Saarland, Germany), with Particular Reference to Microbial Activity,
W83-00048 5C

The Aerobic Mineralization of Amino Acids in the Saline Lake Grevelingen and the Freshwater Haringvliet Basin (The Netherlands),
W83-00178 5C

Effect of a Bacterial Culture Product on Biological Kinetics,
W83-00212 5D

Bacterioplankton Affected by Phosphorus Precipitation Treatment in a Polytrophic Lake,
W83-00315 5G

Preliminary Studies on the Treatment of Canning Factory Effluent with an Integrated Bacterial-Algal-Fish System,
W83-00317 5D

BACTERIAL ANALYSIS
High pH Stabilization of Wastewater Sludge Using Chemical Softening Wastes From Water Treatment,
W83-00243 5D

BANK EROSION
Soil Characterization and Alternate Shoreline Erosion Control Measures for Constructed Lakes in Iowa,
W83-00218 4D

BELGIUM
The Water Supply of the Brussels Urban Area and its Surroundings.
W83-00020 5F

Dissolved Organic Carbon and UV-Absorption in a Polluted Lowland Brook-Pond System,
W83-00024 5G

Some Aspects of the Colonization by Water Mites (Acari, Actinedida) of an Artifical Substrate in a Disturbed Environment,
W83-00054 5C

BENTHIC FAUNA
The Structure and Some Recent Changes of the Zoobenthic Community in the Ermatinger Becken, A Shallow Littoral Part of Lake Constance,
W83-00036 2H

Littoral and Profundal Macroinvertebrate Communities of a Coastal Brown-Water Lake,
W83-00044 2H

BENZIDINES
Determination of Benzidines by Gas Chromatographic Separation of Derivatives with Electron Capture Detection,
W83-00182 5A

Determination of Benzidines in Industrial and Municipal Wastewaters,
W83-00292 5A

BIOACCUMULATION
Observations on the Bioaccumulation Potential of Thorium and Uranium in Rainbow Trout (Salmo Gairdneri),
W83-00021 5C

Heavy Metals in Oysters and Clams of St. Louis Bay, Mississippi,
W83-00159 5C

Polycyclic Aromatic Hydrocarbons in Sewage, Mussels and Tap Water,
W83-00330 5B

The Fate of 2,4,6-Trichlorophenol in an Aquatic Continuous-Flow System,
W83-00332 5B

BIOASSAY
Bioassay Technique for Relative Toxicity in Water Pollution Control,
W83-00146 5A

BIODEGRADATION
Aerobic Degradation of Diuron by Aquatic Microorganisms,
W83-00002 5B

Investigations on Cellulose Biodegradation in Activated Sludge Plants,
W83-00013 5D

BIOLOGICAL CONTROL
Production of Reproductively Limited Grass Carp for Biological Control of Aquatic Weeds - Phase II,
W83-00272 4A

BIOLOGICAL FILTERS
Secondary Treatment.
W83-00325 5D

BIOLOGICAL OXYGEN DEMAND
Bioassay Technique for Relative Toxicity in Water Pollution Control,
W83-00146 5A

BIOLOGICAL WASTEWATER TREATMENT
Fixed-Film Biological Processes,
W83-00191 5D

Advanced Biological Treatment to Achieve Nutrient Removal,
W83-00349 5D

BIOMASS
Diel Periodicity in the Chemical Composition of Lake Phytoplankton,
W83-00049 5B

BIOOXIDATION
Biooxidation of Paint Process Wastewater,
W83-00143 5D

BOB LAKE
Improvements in Quantifying the Phosphorus Concentration in Lake Water,
W83-00208 5C

BOREHOLES
Groundwater is the Answer to Zambia's Water Problem,
W83-00225 4B

BORON
Determination of Boron in River Water with Flameless Atomic Absorption Spectrometry (Graphite Furnace Technique),
W83-00047 5A

BRACKISH WATER
The Incidence of Vibrio Cholerae in Water, Animals and Birds in Kent, England,
W83-00012 5B

BRAIDED STREAMS
Large-Scale Bedforms in the Platte River Downstream from Grand Island, Nebraska: Structure Process, and Relationship to Channel Narrowing,
W83-00111 4D

BRIDGES
Drainage and Structures.
W83-00334 8A

BROMIDES
Nitrate Movement and Denitrification Defined Relative to Bromide Tracer in Tile-Drained Land,
W83-00264 5B

BRUSH CONTROL
Angora Goats for Conversion of Arizona Chaparral: Early Results,
W83-00299 3B

Stream Water Nutrient Changes Associated with the Conversion of Arizona Chaparral,
W83-00300 5B

Water Yield Changes Resulting from Treatment of Arizona Chaparral,
W83-00303 3B

BRUSSELS
The Water Supply of the Brussels Urban Area and its Surroundings.
W83-00020 5F

BY-PRODUCT RECOVERY
Recycling of Mercury and Silver from COD Tests,
W83-00145 5D

CALIFORNIA
Correlation of Rotifer Associations in a Chain of Lakes Fed by Reclaimed Sewage,
W83-00023 5G

An Appraisal of Surface-Water Quality in the Alameda Creek Basin, California, October 1974-June 1979,
W83-00064 5B

In Situ Response of Phytoplankton Fluorescence to Rapid Variations in Light,
W83-00141 5C

An Alternative to the Peripheral Canal,
W83-00193 6G

Role of Fungi in Postfire Stabilization of Chaparral Ash Beds,
W83-00302 4D

Erosion and Sedimentation as Part of the Natural System,
W83-00305 2J

Estimating Hydrologic Values for Planning Wildland Fire Protection,
W83-00306 6B

Seasonal Progressions in the Water Relations of Deciduous and Evergreen Perennials in the Northern California Chaparral,
W83-00307 2I

CANADA
The Recent Histories of Three Canadian Shield Lakes: A Paleolimnological Experiment,
W83-00042 5C

Seasonal Abundance of Ceratium Hirundinella, (O.F. Muller) Schrank in Lakes of Different Trophy,
W83-00052 5C

Water and Waste Management in the Canadian Meat and Poultry Processing Industry.
W83-00082 3E

CANALS
Aquatic Weed Control with Endothall in a Salt River Project Canal,
W83-00166 4A

High Plains - Ogallala Aquifer Study Water Transfer Element,
W83-00312 4A

CARBON CYCLE
Transport of Organic Carbon to the Oceans by Rivers of North America: A Synthesis of Existing Data,
W83-00174 5B

CARCINOGENS
Adsorption of Toxic and Carcinogenic Compounds from Water,
W83-00171 5F

Polynuclear Aromatic Hydrocarbons and Cellular Proliferative Disorders in Bivalue Molluscs from Oregon Estuaries,
W83-00295 5C

CARONI RIVER
The Chemistry and Phytoplankton of the Orinoco and Caroni Rivers, Venezuela,
W83-00187 5B

CASE STUDIES
Case Study Analyses of 208 Program Effectiveness in Improving Regional Water Resources Management,
W83-00240 6B

CATCHMENT BASINS
Soil Survey of the Experimental Catchments Near Bethlehem,
W83-00087 4D

CATIONS
Investigations on the Lakes of Peru and Their Phytoplankton. 6 Additional Chemical Analyses,
W83-00037 2H

Determination of Boron in River Water with Flameless Atomic Absorption Spectrometry (Graphite Furnace Technique),
W83-00047 5A

CELLULOSE
Investigations on Cellulose Biodegradation in Activated Sludge Plants,
W83-00013 5D

CERATIUM HIRUNDINELLA
Seasonal Abundance of Ceratium Hirundinella, (O.F. Muller) Schrank in Lakes of Different Trophy,
W83-00052 5C

CHANNEL MORPHOLOGY
Perennial-Streamflow Characteristics Related to Channel Geometry and Sediment in Missouri River Basin,
W83-00121 4D

Streamflows and Channels of the Green River Basin, Wyoming,
W83-00122 4A

CHANNELS
Large-Scale Bedforms in the Platte River Downstream from Grand Island, Nebraska: Structure Process, and Relationship to Channel Narrowing,
W83-00111 4D

CHAPARRAL
Angora Goats for Conversion of Arizona Chaparral: Early Results,
W83-00299 3B

Stream Water Nutrient Changes Associated with the Conversion of Arizona Chaparral,
W83-00300 5B

Runoff and Sedimentation Potentials Influenced by Litter and Slope on a Chaparral Community in Central Arizona,
W83-00301 4D

Water Yield Changes Resulting from Treatment of Arizona Chaparral,
W83-00303 3B

Erosion and Sedimentation as Part of the Natural System,
W83-00305 2J

Seasonal Progressions in the Water Relations of Deciduous and Evergreen Perennials in the Northern California Chaparral,
W83-00307 2I

CHELATION
Metal Binding Capacity in Relation to Hydrology and Algal Periodicity in Tjeukemeer, the Netherlands,
W83-00039 5B

CHEMICAL ANALYSIS
Carroll County Ground-Water Information: Well Records, Spring Records, and Chemical-Quality Data.
W83-00058 7C

Chemical and Isotopic Composition of Water from Thermal and Mineral Springs of Washington,
W83-00112 2K

Methods for Collection and Analysis of Geopressured Geothermal and Oil Field Waters,
W83-00127 2K

Hazardous Pollutant Analysis in Water Using Infrared Spectroscopy,
W83-00231 5A

The Chemical Composition of Water and the Analytical Chemist: A Challenge,
W83-00290 5A

CHEMICAL COAGULATION
Rapid-Mix Design for Mechanisms of Alum Coagulation,
W83-00170 5F

Improvement in Coal Preparation-Water Clarification Through Polymer Flocculation,
W83-00177 5D

CHEMICAL COMPOSITION
Investigations on the Lakes of Peru and Their Phytoplankton. 6 Additional Chemical Analyses,
W83-00037 2H

Structural Characterization of Aquatic Humic Material,
W83-00190 5C

Daily Chemical Variability of Domestic Septic Tank Effluent,
W83-00328 5D

CHEMICAL OXYGEN DEMAND
Recycling of Mercury and Silver from COD Tests,
W83-00145 5D

CHEMICAL PROPERTIES
Water Quality of Streams in the Great Smoky Mountains National Park,
W83-00032 5B

The Chemistry and Phytoplankton of the Orinoco and Caroni Rivers, Venezuela,
W83-00187 5B

CHEMICAL TREATMENT
Chemical Stability of Water.
W83-00091 5F

CHEMISTRY OF PRECIPITATION
Seasonal Mass Balance of Major Ions in Three Small Watersheds in a Maritime Environment,
W83-00323 2K

CHLORINATION
Disinfection, Odor Prevention and Control.
W83-00154 5D

Development of Chlorine Resistant Membranes, Polyimide Membranes and Porous Substrates,
W83-00246 3A

Disinfection, Taste and Odor Control.
W83-00341 5F

CHLOROPHYLL
Components Contributing to Light Extinction in Natural Water: Method of Isolation,
W83-00213 5A

CHLOROPHYLL A
In Situ Response of Phytoplankton Fluorescence to Rapid Variations in Light,
W83-00141 5C

CHROMATOGRAPHY
Determination of Pyrazon Residues in Water by Reversed Phase High Performance Liquid Chromatography,
W83-00014 5A

Determination of Organic Contaminants in Ultra-Pure Water by Reversed-Phase High-Performance Liquid Chromatography with Ultraviolet Detection,
W83-00202 5A

The Chemical Composition of Water and the Analytical Chemist: A Challenge,
W83-00290 5A

Determination of Benzidines in Industrial and Municipal Wastewaters,
W83-00292 5A

CHROMIUM
Impact of Chromium to the Population Dynamics of Tisbe Holothuriae,
W83-00043 5C

CLAMS
Heavy Metals in Oysters and Clams of St. Louis Bay, Mississippi,
W83-00159 5C

Polynuclear Aromatic Hydrocarbons and Cellular Proliferative Disorders in Bivalue Molluscs from Oregon Estuaries,
W83-00295 5C

CLARIFICATION
Effect of Activated Sludge Operational Conditions on Sludge Thickening Characteristics,
W83-00179 5D

CLARIFIED WASTEWATER
Cause of Inefficient Solids Separation in the Activated Sludge Process,
W83-00232 5D

CLARIFIERS
High-Quality Trickling Filter Effluent Without Tertiary Treatment,
W83-00142 5D

CLEANING
Sewer Maintenance and Rehabilitation.
W83-00156 5D

System Maintenance.
W83-00339 8A

CLEAR-CUTTING
Developing a USLE Cover-Management (C) Factor Procedure for Forest Conditions,
W83-00108 4D

CLIMATIC DATA
Selected Hydrologic and Climatologic Data from the Prairie Dog Creek Basin, Southeastern Montana, Water Year 1980,
W83-00074 7C

Climatic Aspects of Droughts,
W83-00188 3F

CLOSED SYSTEMS
Potential Applications of Water Hyacinth for Water, Air Recycling in Closed Systems,
W83-00324 5G

CLOUD SEEDING
The Toxicology of Silver Iodide in Relation to its use as a Cloud Seeding Agent,
W83-00084 2B

COAL MINES
Sludge Disposal from Acid Mine Drainage Treatment,
W83-00298 5E

COAL MINING
The Role of Hydrologic Variability in Complying with Regulatory Enforcement Standards for the Rehabilitation of Surface-Mined Coal Lands,
W83-00223 6G

COASTAL POLLUTION
Municipal Point Source and Agricultural Nonpoint Source Contribution to Coastal Eutrophication,
W83-00001 5B

COLIFORMS
Coliform Attachment to Suspended Particles in Stormwater,
W83-00224 5B

Increasing Arcat Test Sensitivity for Examination of Potable Waters,
W83-00293 5F

COLIPHAGES
Increasing Arcat Test Sensitivity for Examination of Potable Waters,
W83-00293 5F

COLORADO
Hydrologic Data for Urban Storm Runoff from Nine Sites in the Denver Metropolitan Area, Colorado,
W83-00077 7C

Water-Quality Characteristics of Six Small, Semiarid Watersheds in the Green River Coal Region of Colorado,
W83-00124 5A

Use of Mathematical Models to Predict Impacts of Mining Energy Minerals on the Hydrologic System in Northwestern Colorado,
W83-00168 4C

COLUMBIA GLACIER
Continuity Equation Model of the Predicted Drastic Retreat of Columbia Glacier, Alaska,
W83-00119 2C

COMBINED SEWER OVERFLOWS
Management and Control Technology for Urban Stormwater Pollution,
W83-00148 5G

COMPACTION
Approximately Water-Level Changes in Wells in the Chicot and Evangeline Aquifers 1977-82 and 1981-82, and Measured Compaction 1973-82, in the Houston-Galveston Region, Texas,
W83-00075 7C

COMPUTER MODELS
Applications of Digital Modeling for Evaluating the Ground-Water Resources of the '2,000-Foot' Sand of the Baton Rouge Area, Louisiana,
W83-00109 4B

Finite Element Glacier Dynamics Model Applied to Columbia Glacier, Alaska,
W83-00118 2C

Continuity Equation Model of the Predicted Drastic Retreat of Columbia Glacier, Alaska,
W83-00119 2C

Estimated Effects of Projected Ground-Water With-Drawals on Movement of the Saltwater Front in the Floridan Aquifer, 1976-2000, West-Central Florida,
W83-00130 4B

IIHR Distrubuted Parameter Watershed Model,
W83-00269 2E

Water Quality Simulation of Wahiawa Reservoir, O'Ahu, Hawaii,
W83-00281 5G

COMPUTER PROGRAMS
Adaptation of the ILLUDAS Model to a Desktop Computer,
W83-00081 7B

The Analyses of Areal Rainfall Using Multi-Quadric Surfaces,
W83-00088 2B

Finite Element Glacier Dynamics Model Applied to Columbia Glacier, Alaska,
W83-00118 2C

Efficient Use of Water for Irrigation in the Upper Midwest,
W83-00242 3F

Assessment of the Usefulness of Hydrologic Data for Hydropower Feasibility Analysis,
W83-00251 2E

COMPUTERS
Adaptation of the ILLUDAS Model to a Desktop Computer,
W83-00081 7B

Practical Techniques of River Monitoring and Pollution Forecasting,
W83-00238 5B

CONFERENCES
A Cooperative Water Resource Technology Transfer Program,
W83-00216 6B

CONFINED AQUIFERS
Deep Artesian Aquifers of Sanibel and Captiva Islands, Lee County, Florida,
W83-00114 4B

CONNECTICUT
Heavy Metal Interactions and Dynamics in Simulated Naugatuck River Microcosms,
W83-00214 5B

CONNECTICUT RIVER
Seasonal Changes of Dissolved Sodium in the Connecticut River Near Northfield, Massachusetts,
W83-00139 5B

CONSTRUCTION
Design and Construction of the Pennichuck Water Treatment Plant: The Engineer's View,
W83-00135 5F

Design and Construction of the Pennichuck Water Treatment Plant: The Construction Manager's View,
W83-00136 5F

Collection Systems.
W83-00338 8C

CONTINUITY EQUATION
Finite Element Glacier Dynamics Model Applied to Columbia Glacier, Alaska,
W83-00118 2C

Continuity Equation Model of the Predicted Drastic Retreat of Columbia Glacier, Alaska,
W83-00119 2C

CONTRACTS
Design and Construction of the Pennichuck Water Treatment Plant: The Construction Manager's View,
W83-00136 5F

CONVEYANCE STRUCTURES
Mains and Services.
W83-00313 8C

Collection Systems.
W83-00338 8C

System Maintenance.
W83-00339 8A

COPEPODS
Impact of Chromium to the Population Dynamics of Tisbe Holothuriae,
W83-00043 5C

COPPER
Metal Binding Capacity in Relation to Hydrology and Algal Periodicity in Tjeukemeer, the Netherlands,
W83-00039 5B

Guidelines for Surface Water Quality: Vol 1: Inorganic Chemical Substances: Copper,
W83-00079 5G

CORROSION CONTROL
Chemical Stability of Water.
W83-00091 5F

Cathodic Protection of Water Mains,
W83-00175 8G

CORROSIVE WATER
New EPA Sodium and Corrosion Regulations: Their Basis and Impacts,
W83-00137 5G

COST ALLOCATION
Lump Sum Tax Loss Reimbursement Under the Thames River Flood Control Compact,
W83-00005 6B

COST ANALYSIS
Design and Construction of the Pennichuck Water Treatment Plant: The Engineer's View,
W83-00135 5F

Effects of Michigan's Phosphorus Detergent Ban on Municipal Chemical Costs,
W83-00147 5G

Incentives for Irrigation Water Conservation in Agriculture,
W83-00278 3F

CREAMS
Estimating Sediment Yield from Rangeland with CREAMS,
W83-00103 2J

CROP PRODUCTION
Application of Remote Sensing in Evaluating Floodwater Farming on the Papago Indian Reservation,
W83-00230 3F

Land Application of Municipal Sludge with Regard to Cropping Systems and Pollution Potential,
W83-00233 5E

Conservation Through Crops Research,
W83-00311 3F

CROP YIELD
Variability in Crop Physiological and Morphological Characteristics Controlling Water Use Efficiency and Grain Yield,
W83-00234 3F

Water-Use Production Functions of Selected Agronomic Crops in Northwestern New Mexico, Phase I,
W83-00235 3F

A Weighing Lysimeter Facility at Roodeplaat for Crop Evapotranspiration Studies,
W83-00287 2D

CROPLAND
Spreading Lagooned Sewage Sludge on Farmland: A Case History,
W83-00296 5E

CULTIVATE LANDS
Land Application of Municipal Sludge with Regard to Cropping Systems and Pollution Potential,
W83-00233 5E

CULTURES
Microorganisms Capable of Degrading Refractory Hydrocarbons in Ohio Waters,
W83-00219 5B

CULVERTS
Drainage and Structures.
W83-00334 8A

CYANOPHYTA
Excretion and DOC Utilization by Oscillatoria Rubescens D.C. and its Accompanying Micro-Organisms,
W83-00183 5C

DAILY HYDROGRAPHS
Stochastic Daily Precipitation Modeling and Daily Streamflow Transfer Processes,
W83-00282 2E

DAM DESIGN
Kielder - Planning to Meet the Future.
W83-00207 8A

DAM EFFECTS
Environmental Impact of Large Hydroelectric Projects on Tropical Countries,
W83-00010 6G

Final Environmental Impact Statement of the White River Dam Project.
W83-00297 6G

DAM FAILURE
The Flow of Slurry from a Breached Tailings Dam,
W83-00285 8B

DAM SAFETY
Plumbline Monitor Interface,
W83-00094 8G

DATA ACQUISITION
U.S. Geological Survey Federal-State Program,
W83-00201 6E

DATA COLLECTIONS
Carroll County Ground-Water Information: Well Records, Spring Records, and Chemical-Quality Data.
W83-00058 7C

Manual for Leveling at Gaging Stations in North Carolina,
W83-00065 7B

Water-Resources Investigations of the U.S. Geological Survey in New Mexico, Fiscal Year 1980.
W83-00073 7A

Selected Hydrologic and Climatologic Data from the Prairie Dog Creek Basin, Southeastern Montana, Water Year 1980,
W83-00074 7C

Hydrologic Data for the Alluvium and Terrace Aquifer of the Beaver-North Canadian River from the Panhandle to Canton Reservoir, Northwestern Oklahoma,
W83-00110 7C

Water-Quality Characteristics of Six Small, Semiarid Watersheds in the Green River Coal Region of Colorado,
W83-00124 5A

U.S. Geological Survey Federal-State Program,
W83-00201 6E

A Depth-Duration-Frequency Diagram for Point Rainfall in Swa-Namibia,
W83-00289 2B

DATA INTERPRETATION
A Depth-Duration-Frequency Diagram for Point Rainfall in Swa-Namibia,
W83-00289 2B

DATA PROCESSING
Trade Effluent Control and the Microprocessor,
W83-00003 5G

DATA TRANSMISSION
Policy Objectives and Information System for Irrigation Projects-India,
W83-00011 6A

DECISION MAKING
Effective Graphical Display of Water Resource Planning Information for Decision Makers, Volume I,
W83-00273 10D

Effective Graphical Display of Water Resources Planning Information for Decision Makers, Volume II,
W83-00274 10D

DECOMPOSITION
Nitrogen Metabolism in Lake Kizaki, Japan II. Distribution and Decomposition of Organic Nitrogen,
W83-00345 2H

DELTAS
An Alternative to the Peripheral Canal,
W83-00193 6G

DENITRIFICATION
Distribution of Denitrifying Bacteria and its Controlling Factors in Freshwater Environments,
W83-00018 5C

Nitrate Movement and Denitrification Defined Relative to Bromide Tracer in Tile-Drained Land,
W83-00264 5B

DENITRIFYING BACTERIA
Distribution of Denitrifying Bacteria and its Controlling Factors in Freshwater Environments,
W83-00018 5C

DEPTH-AREA-DURATION ANALYSIS
A Depth-Duration-Frequency Diagram for Point Rainfall in Swa-Namibia,
W83-00289 2B

DES MOINES RIVER
Application to the Des Moines River of Multiple Reservoir Operating Strategies Incorporating Short-and Long-Term Information in Real Time,
W83-00248 4A

DESALINATION
Development of New Chemical Additives and Treatments for Scale Control in Saline Water Evaporators,
W83-00222 3A

Hydrodynamics and Fouling of Pressure Driven Membrane Desalination and Water Treatment Systems,
W83-00244 3A

Development and Demonstration of a Reverse-Osmosis Energy-Recovery Device,
W83-00256 3A

Development of Novel Porous Substrates for Ultrafiltration, Desalination and Water Reclamation--Part III,
W83-00259 3A

Preparation of Thin-Ion-Exchange Membranes with Exceptionally Low Resistances and High Selectivities.
W83-00261 3A

Development of Composite Hollow Fibers - Phase III,
W83-00267 3A

Diatomite Precoat Filtration for Pretreatment of Seawater Prior to Reverse Osmosis,
W83-00270 3A

Use of the Water-Salt Balance Method for Calculating the Desalination Regime of a Large Water Body,
W83-00322 5G

DESALINATION APPARATUS
Development and Demonstration of a Reverse-Osmosis Energy-Recovery Device,
W83-00256 3A

Development of Composite Hollow Fibers - Phase III,
W83-00267 3A

DESIGN CRITERIA
Preparation of Thin-Ion-Exchange Membranes with Exceptionally Low Resistances and High Selectivities.
W83-00261 3A

Assessment of Low Head, Micro Hydroelectric Equipment for Use on Small Tropical Islands,
W83-00268 8C

Blackheath Water Treatment Plant,
W83-00283 5F

A Weighing Lysimeter Facility at Roodeplaat for Crop Evapotranspiration Studies,
W83-00287 2D

DETERGENTS
Mineralization of Linear Alcohol Ethoxylates and Linear Alcohol Ethoxy Sulfates at Trace Concentrations in Estuarine Water,
W83-00211 5B

DETRITUS
Potential Flood and Debris Hazards at Cottonwood Cove, Lake Mead National Recreation Area, Clark County, Nevada,
W83-00070 2E

DEVELOPING COUNTRIES
Developing and Applying International Water Quality Guidelines,
W83-00167 5G

DIATOMACEOUS EARTH
Diatomite Precoat Filtration for Pretreatment of Seawater Prior to Reverse Osmosis,
W83-00270 3A

DISINFECTION
Disinfection, Odor Prevention and Control.
W83-00154 5D

Wastewater Flocculation-Filtration and Post Disinfection,
W83-00239 5D

Increasing Arcat Test Sensitivity for Examination of Potable Waters,
W83-00293 5F

Disinfection, Taste and Odor Control.
W83-00341 5F

DISSOLVED ORGANIC MATTER
Excretion and DOC Utilization by Oscillatoria Rubescens D.C. and its Accompanying Micro-Organisms,
W83-00183 5C

DISTRICT OF COLUMBIA
Reservoir Management in Potomac River Basin,
W83-00203 6A

A Curriculum for Water Supply and Wastewater Operation, Maintenance and Management,
W83-00247 5G

DIURNAL DISTRIBUTION
Diel Periodicity in the Chemical Composition of Lake Phytoplankton,
W83-00049 5B

DIURON
Aerobic Degradation of Diuron by Aquatic Microorganisms,
W83-00002 5B

DOMESTIC WASTES
Daily Chemical Variability of Domestic Septic Tank Effluent,
W83-00328 5D

DRAINAGE
Adjustment of Soil Limitations,
W83-00286 2G

DRAINAGE EFFECTS
Nitrate Contamination of Groundwater on the Old Mission Peninsula: Contribution of Land Reshaping and Septic Drainfields,
W83-00228 5B

DRAINAGE ENGINEERING
Drainage and Structures.
W83-00334 8A

DRAINAGE SYSTEMS
Drainage and Structures.
W83-00334 8A

DREDGING
The Clean Water Act's Section 404 Permit Program Enters its Adolescence: An Institutional and Programmatic Perspective,
W83-00210 5G

DRINKING WATER
Seasonal Changes of Dissolved Sodium in the Connecticut River Near Northfield, Massachusetts,
W83-00139 5B

Developing and Applying International Water Quality Guidelines,
W83-00167 5G

West River Gets Innovative Technology,
W83-00197 5F

Water Treatment for Small Public Supplies,
W83-00280 5F

Polycyclic Aromatic Hydrocarbons in Sewage, Mussels and Tap Water,
W83-00330 5B

Water Supply and Treatment, Section C-1, Raw Water Preparation.
W83-00335 5F

Disinfection, Taste and Odor Control.
W83-00341 5F

Softening, Iron and Manganese Removal.
W83-00342 5F

DROUGHT
Social and Political Aspects of Drought,
W83-00186 6B

Climatic Aspects of Droughts,
W83-00188 3F

Water Resource System Reliability Under Drought Conditions: The Seattle Water Supply System as a Case Study,
W83-00229 3D

Stochastic Daily Precipitation Modeling and Daily Streamflow Transfer Processes,
W83-00282 2E

DYE INDUSTRY WASTES
Determination of Benzidines in Industrial and Municipal Wastewaters,
W83-00292 5A

DYE RELEASES
Streamflows and Channels of the Green River Basin, Wyoming,
W83-00122 4A

EARTH DAMS
Kielder - Planning to Meet the Future.
W83-00207 8A

ECOLOGICAL EFFECTS
Irrigation Planning in the Tana Basin of Kenya,
W83-00015 6B

Some Notes on the Ecology of Aquatic Oligochaetes in the Delta Region of the Netherlands,
W83-00035 2L

ECONOMIC ASPECTS
The Probability Distribution of Water Inputs and the Economic Benefits of Supplementary Irrigation,
W83-00016 6A

The Ogallala--Half Full or Half Empty.,
W83-00017 6D

A Cooperative Water Resource Technology Transfer Program,
W83-00216 6B

ECONOMIC IMPACT
High Plains-Ogallala Aquifer Study, New Mexico -- Economic Impacts,
W83-00308 6B

ECOSYSTEMS
The Ecology of the Mangroves of South Florida: A Community Profile,
W83-00093 6G

Persistence in Model Ecosystems,
W83-00294 5B

EDUCATION
A Curriculum for Water Supply and Wastewater Operation, Maintenance and Management,
W83-00247 5G

EFFLUENT CHARGES
Trade Effluent Control and the Microprocessor,
W83-00003 5G

EFFLUENTS
Effects of Effluent Spray Irrigation on Ground Water at a Test Site Near Tarpon Springs, Florida,
W83-00068 5B

ELECTRODIALYSIS
Water Treatment for Small Public Supplies,
W83-00280 5F

ENERGY RECOVERY
Development and Demonstration of a Reverse-Osmosis Energy-Recovery Device,
W83-00256 3A

ENGLAND
The Incidence of Vibrio Cholerae in Water, Animals and Birds in Kent, England,
W83-00012 5B

Diel Periodicity in the Chemical Composition of Lake Phytoplankton,
W83-00049 5B

The Development of Attenuance Depth-Profiling to Follow the Changing Distribution of Phytoplankton and Other Particulate Material in a Productive English Lake,
W83-00055 5C

Accuracy of Determination of Ammoniacal Nitrogen in River Waters: Analytical Quality Control in the Harmonised Monitoring Scheme.
W83-00196 5A

ENVIRONMENTAL EFFECTS
The Toxicology of Silver Iodide in Relation to its use as a Cloud Seeding Agent,
W83-00084 2B

Final Environmental Impact Statement of the White River Dam Project.
W83-00297 6G

High Plains - Ogallala Aquifer Study Water Transfer Element,
W83-00312 4A

ENVIRONMENTAL IMPACT STATEMENT
Final Environmental Impact Statement of the White River Dam Project.
W83-00297 6G

ENVIRONMENTAL TRACERS
Nitrate Movement and Denitrification Defined Relative to Bromide Tracer in Tile-Drained Land,
W83-00264 5B

Groundwater in the Inner Bluegrass Karst Region, Kentucky,
W83-00275 2F

ENZYMES
Induction of High Phosphatase Activity by Aluminum in Acid Lakes,
W83-00029 5B

Phytoplankton Contribution to Alkaline Phosphatase Activity,
W83-00041 2H

Characterization of Acid Phosphatases in the Acidified Lake Gardsjon, Sweden,
W83-00050 5C

EROSION CONTROL
Relation of USLE Factors to Erosion on Rangeland,
W83-00096 2J

Soil Characterization and Alternate Shoreline Erosion Control Measures for Constructed Lakes in Iowa,
W83-00218 4D

Role of Fungi in Postfire Stabilization of Chaparral Ash Beds,
W83-00302 4D

EROSION INDEX
The USLE Rainfall Factor for Southwestern U. S. Rangelands,
W83-00098 4D

EROSION RATES
The Spatial Distribution in Southern Africa of Rainfall Erosivity for Use in the Universal Soil Loss Equation,
W83-00140 2J

ESCAMBIA BAY
Mineralization of Linear Alcohol Ethoxylates and Linear Alcohol Ethoxy Sulfates at Trace Concentrations in Estuarine Water,
W83-00211 5B

ESTIMATED COSTS
Assessment of Low Head, Micro Hydroelectric Equipment for Use on Small Tropical Islands,
W83-00268 8C

ESTUARIES
Municipal Point Source and Agricultural Nonpoint Source Contribution to Coastal Eutrophication,
W83-00001 5B

An Alternative to the Peripheral Canal,
W83-00193 6G

ESTUARINE ENVIRONMENT
Anoxic Nutrient Regeneration and the Eutrophication of Estuarine Waters,
W83-00263 5C

EUTROPHIC LAKES
Control of Lake Phosphorus with Aluminum Sulfate: Dose Determination and Application Techniques,
W83-00006 5C

The Sediments of the New Artificial Lake Bostalsee (Saarland, Germany), with Particular Reference to Microbial Activity,
W83-00048 5C

Diel Periodicity in the Chemical Composition of Lake Phytoplankton,
W83-00049 5B

Seasonal Abundance of Ceratium Hirundinella, (O.F. Muller) Schrank in Lakes of Different Trophy,
W83-00052 5C

Excretion and DOC Utilization by Oscillatoria Rubescens D.C. and its Accompanying Micro-Organisms,
W83-00183 5C

Phosphate and Wind in a Shallow Lake,
W83-00184 5B

Lake Restoration Technology Transfer Assessment,
W83-00215 5G

An Evaluation of the Recovery of Adirondack Acid Lakes by Chemical Manipulation,
W83-00245 5G

EUTROPHICATION
Municipal Point Source and Agricultural Nonpoint Source Contribution to Coastal Eutrophication,
W83-00001 5B

Mass Balance Model Estimation of Phosphorus Concentrations in Reservoirs,
W83-00009 5C

Applicability of Phosphorus Budget Models to Southern African Man-Made Lakes,
W83-00025 5C

Paleoecological Studies of the Recent Development of the Lake Vaxjosjon. IV. Interpretation of the Eutrophication Process Through the Analysis of Subfossil Chironomids,
W83-00028 5C

The Structure and Some Recent Changes of the Zoobenthic Community in the Ermatinger Becken, A Shallow Littoral Part of Lake Constance,
W83-00036 2H

The Sediments of the New Artificial Lake Bostalsee (Saarland, Germany), with Particular Reference to Microbial Activity,
W83-00048 5C

Seasonal Abundance of Ceratium Hirundinella, (O.F. Muller) Schrank in Lakes of Different Trophy,
W83-00052 5C

Anoxic Nutrient Regeneration and the Eutrophication of Estuarine Waters,
W83-00263 5C

The Occurrence of a Fungal Parasite on a Tetraselmis (Prasinophyceae) Species,
W83-00288 5C

The Relationship Between Nutrient Status and Chemical Composition of Peridinium Cinctum During the Bloom in Lake Kinneret,
W83-00333 5C

EVAPORATION RATE
Pine Tree Evapotranspiration,
W83-00279 2D

EVAPORATORS
Development of New Chemical Additives and Treatments for Scale Control in Saline Water Evaporators,
W83-00222 3A

EVAPOTRANSPIRATION
Pine Tree Evapotranspiration,
W83-00279 2D

EVAPOTRANSPIRATION POTENTIAL
A Weighing Lysimeter Facility at Roodeplaat for Crop Evapotranspiration Studies,
W83-00287 2D

Measurement and Mapping of Potential Evapotranspiration in a Small Mountainous Watershed,
W83-00346 2D

EXCRETION
Excretion and DOC Utilization by Oscillatoria Rubescens D.C. and its Accompanying Micro-Organisms,
W83-00183 5C

FARM WASTES
Municipal Point Source and Agricultural Nonpoint Source Contribution to Coastal Eutrophication,
W83-00001 5B

FATE OF POLLUTANTS
Aerobic Degradation of Diuron by Aquatic Microorganisms,
W83-00002 5B

The Incidence of Vibrio Cholerae in Water, Animals and Birds in Kent, England,
W83-00012 5B

Water Characteristics,
W83-00169 5B

Persistence in Model Ecosystems,
W83-00294 5B

FATTY ACIDS
Anaerobic Digestion of Free Volatile Fatty Acids in Soils Below Waste Tips,
W83-00326 5D

FEASIBILITY STUDIES
Assessment of the Usefulness of Hydrologic Data for Hydropower Feasibility Analysis,
W83-00251 2E

Evaluation of Limnological Parameters as Related to the Success of Mysis Relicta Introductions,
W83-00254 8I

Development of Composite Hollow Fibers - Phase III,
W83-00267 3A

Assessment of Low Head, Micro Hydroelectric Equipment for Use on Small Tropical Islands,
W83-00268 8C

FEEDLOT WASTES
Stabilizing High-Strength Wastes with Photosynthetic Bacteria,
W83-00181 5D

FILMS
Fixed-Film Biological Processes,
W83-00191 5D

FILTRATION
West River Gets Innovative Technology,
W83-00197 5F

New Technology for Drinking Water Treatment,
W83-00198 5F

Wastewater Flocculation-Filtration and Post Disinfection,
W83-00239 5D

Diatomite Precoat Filtration for Pretreatment of Seawater Prior to Reverse Osmosis,
W83-00270 3A

FINANCIAL FEASIBILITY
Diatomite Precoat Filtration for Pretreatment of Seawater Prior to Reverse Osmosis,
W83-00270 3A

FINITE ELEMENT METHOD
Finite Element Glacier Dynamics Model Applied to Columbia Glacier, Alaska,
W83-00118 2C

FINLAND
Dynamics of Phytoplankton in Finnish Lakes,
W83-00153 5C

The Fate of 2,4,6-Trichlorophenol in an Aquatic Continuous-Flow System,
W83-00332 5B

FIRES
Role of Fungi in Postfire Stabilization of Chaparral Ash Beds,
W83-00302 4D

Estimating Hydrologic Values for Planning Wildland Fire Protection,
W83-00306 6B

FISH ATTRACTANTS
Some Variations in Distribution of Fishes in Large Mainstream Reservoirs Associated with Artificial Cover,
W83-00255 8I

FISH BEHAVIOR
Some Variations in Distribution of Fishes in Large Mainstream Reservoirs Associated with Artificial Cover,
W83-00255 8I

FISH MIGRATION
Some Variations in Distribution of Fishes in Large Mainstream Reservoirs Associated with Artificial Cover,
W83-00255 8I

FISH POPULATIONS
Evaluation of Limnological Parameters as Related to the Success of Mysis Relicta Introductions,
W83-00254 8I

Some Variations in Distribution of Fishes in Large Mainstream Reservoirs Associated with Artificial Cover,
W83-00255 8I

Instream Salmonid Habitat Exclusion by Ice-Cover,
W83-00257 8I

Production of Reproductively Limited Grass Carp for Biological Control of Aquatic Weeds - Phase II,
W83-00272 4A

FISH TOXINS
The Fate of 2,4,6-Trichlorophenol in an Aquatic Continuous-Flow System,
W83-00332 5B

FLASH FLOODS
Potential Flood and Debris Hazards at Cottonwood Cove, Lake Mead National Recreation Area, Clark County, Nevada,
W83-00070 2E

FLOCCULATION
Improvement in Coal Preparation-Water Clarification Through Polymer Flocculation,
W83-00177 5D

Wastewater Flocculation-Filtration and Post Disinfection,
W83-00239 5D

FLOOD FLOW
Floodflow Characteristics Related to Channel Geometry in Ohio,
W83-00067 2E

FLOOD FORECASTING
The Statistics of Extreme Values and the Analyses of Floods in South Africa,
W83-00089 2E

FLOOD FREQUENCY
Annual Peak Discharges from Small Drainage Areas in Montana Through September 1981,
W83-00071 2E

FLOOD PEAK
Annual Peak Discharges from Small Drainage Areas in Montana Through September 1981,
W83-00071 2E

FLOOD PLAIN MANAGEMENT
Lump Sum Tax Loss Reimbursement Under the Thames River Flood Control Compact,
W83-00005 6B

FLOODS
Floodflow Characteristics Related to Channel Geometry in Ohio,
W83-00067 2E

Annual Peak Discharges from Small Drainage Areas in Montana Through September 1981,
W83-00071 2E

The Statistics of Extreme Values and the Analyses of Floods in South Africa,
W83-00089 2E

Investigation of Trends in Flooding in the Tug Fork Basin of Kentucky, Virginia, and West Virginia,
W83-00128 4A

Stochastic Daily Precipitation Modeling and Daily Streamflow Transfer Processes,
W83-00282 2E

Estimating Hydrologic Values for Planning Wildland Fire Protection,
W83-00306 6B

FLOODWATER
Application of Remote Sensing in Evaluating Floodwater Farming on the Papago Indian Reservation,
W83-00230 3F

FLORIDA
Effects of Effluent Spray Irrigation on Ground Water at a Test Site Near Tarpon Springs, Florida,
W83-00068 5B

The Ecology of the Mangroves of South Florida: A Community Profile,
W83-00093 6G

Quality of Surface Water at Selected Sites in the Suwannee River Basin, Florida, 1980,
W83-00113 7C

Deep Artesian Aquifers of Sanibel and Captiva Islands, Lee County, Florida,
W83-00114 4B

Hydrogeology and Results of Injection Tests at Waste-Injection Test Sites in Pinellas County, Florida,
W83-00129 5B

Estimated Effects of Projected Ground-Water With-Drawals on Movement of the Saltwater Front in the Floridan Aquifer, 1976-2000, West-Central Florida,
W83-00130 4B

Mineralization of Linear Alcohol Ethoxylates and Linear Alcohol Ethoxy Sulfates at Trace Concentrations in Estuarine Water,
W83-00211 5B

Water Quality Criteria and Effluent Requirements in Broward County, Florida,
W83-00320 5G

Advanced Biological Treatment to Achieve Nutrient Removal,
W83-00349 5D

FLOTATION
Textile Industry Wastewater Treatment by Air Flotation,
W83-00080 5D

Improvements in Foam Flotation for Lead Removal,
W83-00150 5D

Algae Removal by Induced Air Flotation,
W83-00277 5G

FLOW CHARACTERISTICS
Low-Flow Characteristics and Flow Duration of New Jersey Streams,
W83-00061 7C

Floodflow Characteristics Related to Channel Geometry in Ohio,
W83-00067 2E

Perennial-Streamflow Characteristics Related to Channel Geometry and Sediment in Missouri River Basin,
W83-00121 4D

Streamflows and Channels of the Green River Basin, Wyoming,
W83-00122 4A

The Flow of Slurry from a Breached Tailings Dam,
W83-00285 8B

FLOW DISCHARGE
Hydrologic Data for Experimental Agricultural Watersheds in the United States, 1973,
W83-00095 7C

FLOW DURATION
Low-Flow Characteristics and Flow Duration of New Jersey Streams,
W83-00061 7C

Assessment of the Usefulness of Hydrologic Data for Hydropower Feasibility Analysis,
W83-00251 2E

FLOW INJECTION ANALYSIS
Determination of Iron in Natural Waters and Plant Material with 1,10-Phenanthroline by Flow Injection Analysis,
W83-00194 5A

FLOW MEASUREMENT
Operation Control.
W83-00155 5G

Intensive Flow Monitoring--Cost-Effectiveness with a Quality Edge,
W83-00200 5G

FLUORESCENCE
In Situ Response of Phytoplankton Fluorescence to Rapid Variations in Light,
W83-00141 5C

FLUORIDES
Softening, Iron and Manganese Removal.
W83-00342 5F

FOAM SEPARATION
Improvements in Foam Flotation for Lead Removal,
W83-00150 5D

FOAMING
Algae Removal by Induced Air Flotation,
W83-00277 5G

FOOD-PROCESSING WASTES
Preliminary Studies on the Treatment of Canning Factory Effluent with an Integrated Bacterial-Algal-Fish System,
W83-00317 5D

FORECASTING
Practical Techniques of River Monitoring and Pollution Forecasting,
W83-00238 5B

FOREST MANAGEMENT
Developing a USLE Cover-Management (C) Factor Procedure for Forest Conditions,
W83-00108 4D

FOSSILS
Paleoecological Studies of the Recent Development of the Lake Vaxjosjon. IV. Interpretation of the Eutrophication Process Through the Analysis of Subfossil Chironomids,
W83-00028 5C

FOULING
Hydrodynamics and Fouling of Pressure Driven Membrane Desalination and Water Treatment Systems,
W83-00244 3A

FRACTURE SPRINGS
Use of Fracture Traces in Water Well Location: a Handbook.
W83-00217 4B

FREQUENCY ANALYSIS
Low Flow of Streams in Fairfax County, Virginia,
W83-00062 4C

FURROW IRRIGATION
Water Saving Techniques,
W83-00309 3F

GAS CHROMATOGRAPHY
Multiple Purge Techniques for Determining Organic Pollutants in Groundwater,
W83-00158 5A

Determination of Benzidines by Gas Chromatographic Separation of Derivatives with Electron Capture Detection,
W83-00182 5A

GEOHYDROLOGY
Geohydrology of Southwestern Kansas,
W83-00059 7C

Hydrologic Data for the Alluvium and Terrace Aquifer of the Beaver-North Canadian River from the Panhandle to Canton Reservoir, Northwestern Oklahoma,
W83-00110 7C

Groundwater in the Inner Bluegrass Karst Region, Kentucky,
W83-00275 2F

GEOLOGIC FRACTURES
Use of Fracture Traces in Water Well Location: a Handbook.
W83-00217 4B

GEOLOGIC MAPPING
Geohydrology of the Valley-Fill Aquifer in the South Fallsburgh-Woodbourne Area, Sullivan County, New York,
W83-00069 7C

Geohydrology of the Valley-Fill Aquifer in the Schenectady Area, Schenectady County, New York,
W83-00116 7C

Geohydrology of the Valley-Fill Aquifer in the Corning Area, Steuben County, New York,
W83-00117 7C

Geologic Criteria in Waste-Management Site Selection in Northeastern North Dakota,
W83-00236 5E

GEORGIA
Littoral and Profundal Macroinvertebrate Communities of a Coastal Brown-Water Lake,
W83-00044 2H

GEOTHERMAL STUDIES
Methods for Collection and Analysis of Geopressured Geothermal and Oil Field Waters,
W83-00127 2K

GLACIER MASS BALANCE
Continuity Equation Model of the Predicted Drastic Retreat of Columbia Glacier, Alaska,
W83-00119 2C

GLACIERS
Finite Element Glacier Dynamics Model Applied to Columbia Glacier, Alaska,
W83-00118 2C

Continuity Equation Model of the Predicted Drastic Retreat of Columbia Glacier, Alaska,
W83-00119 2C

GOATS
Angora Goats for Conversion of Arizona Chaparral: Early Results,
W83-00299 3B

GRAIN CROPS
Variability in Crop Physiological and Morphological Characteristics Controlling Water Use Efficiency and Grain Yield,
W83-00234 3F

GRAPHICAL ANALYSIS
Soil Maps of Montana,
W83-00237 7C

GRAPHICAL METHODS
Effective Graphical Display of Water Resource Planning Information for Decision Makers, Volume I,
W83-00273 10D

Effective Graphical Display of Water Resources Planning Information for Decision Makers, Volume II,
W83-00274 10D

GRASS CARP
Production of Reproductively Limited Grass Carp for Biological Control of Aquatic Weeds - Phase II,
W83-00272 4A

GRAZING
Use of Erosion Models on Western Rangelands,
W83-00097 2J

Predicting Sediment Yields from Sagebrush Rangelands,
W83-00106 4D

GROUNDWATER
Water Resources Data, Louisiana, Water Year 1981--Volume 2. Southern Louisiana.
W83-00057 7C

Carroll County Ground-Water Information: Well Records, Spring Records, and Chemical-Quality Data.
W83-00058 7C

Installation and Sampling of Observation Wells and Analyses of Water from the Shallow Aquifer at Selected Waste-Disposal Sites in the Memphis Area, Tennessee,
W83-00066 5B

Effects of Effluent Spray Irrigation on Ground Water at a Test Site Near Tarpon Springs, Florida,
W83-00068 5B

Geohydrology of the Valley-Fill Aquifer in the South Fallsburgh-Woodbourne Area, Sullivan County, New York,
W83-00069 7C

Water-Resources Investigations of the U.S. Geological Survey in New Mexico, Fiscal Year 1980.
W83-00073 7A

Approximately Water-Level Changes in Wells in the Chicot and Evangeline Aquifers 1977-82 and 1981-82, and Measured Compaction 1973-82, in the Houston-Galveston Region, Texas,
W83-00075 7C

Selected Hydrogeologic Data from Southern Sweet Grass County, South-Central Montana,
W83-00076 7C

Applications of Digital Modeling for Evaluating the Ground-Water Resources of the '2,000-Foot' Sand of the Baton Rouge Area, Louisiana,
W83-00109 4B

Hydrologic Data for the Alluvium and Terrace Aquifer of the Beaver-North Canadian River from the Panhandle to Canton Reservoir, Northwestern Oklahoma,
W83-00110 7C

Deep Artesian Aquifers of Sanibel and Captiva Islands, Lee County, Florida,
W83-00114 4B

Geohydrology of the Valley-Fill Aquifer in the Schenectady Area, Schenectady County, New York,
W83-00116 7C

Geohydrology of the Valley-Fill Aquifer in the Corning Area, Steuben County, New York,
W83-00117 7C

Summary Appraisals of the Nation's Ground-Water Resources--New England Region,
W83-00120 4B

Designation of Principal Water-Supply Aquifers in Minnesota,
W83-00125 2F

Hydrogeology and Results of Injection Tests at Waste-Injection Test Sites in Pinellas County, Florida,
W83-00129 5B

Estimated Effects of Projected Ground-Water With-Drawals on Movement of the Saltwater Front in the Floridan Aquifer, 1976-2000, West-Central Florida,
W83-00130 4B

Water Resources Data for New York, Water Year 1981--Volume 3. Western New York.
W83-00131 7C

Water Resources Data for North Carolina, Water Year 1981.
W83-00132 7C

GROUNDWATER AVAILABILITY
Use of Fracture Traces in Water Well Location: a Handbook.
W83-00217 4B

GROUNDWATER BASINS
Groundwater in the Inner Bluegrass Karst Region, Kentucky,
W83-00275 2F

GROUNDWATER DEPLETION
The Ogallala--Half Full or Half Empty.,
W83-00017 6D

GROUNDWATER MINING
Groundwater is the Answer to Zambia's Water Problem,
W83-00225 4B

GROUNDWATER MOVEMENT
Geohydrology of the Valley-Fill Aquifer in the South Fallsburgh-Woodbourne Area, Sullivan County, New York,
W83-00069 7C

Geohydrology of the Valley-Fill Aquifer in the Schenectady Area, Schenectady County, New York,
W83-00116 7C

Geohydrology of the Valley-Fill Aquifer in the Corning Area, Steuben County, New York,
W83-00117 7C

Tracing Well Water Pollution in a Limestone Aquifer,
W83-00173 5B

A Preliminary Study of Natural Aquifer Discharge of Guam,
W83-00271 5B

Groundwater in the Inner Bluegrass Karst Region, Kentucky,
W83-00275 2F

GROUNDWATER POLLUTION
Characterization of Plutonium in Ground Water Near the Idaho Chemical Processing Plant,
W83-00019 5B

Multiple Purge Techniques for Determining Organic Pollutants in Groundwater,
W83-00158 5A

Tracing Well Water Pollution in a Limestone Aquifer,
W83-00173 5B

Control Measures for Groundwater VOCS,
W83-00199 5F

The Effects of the Disposal of Sewage Effluents on Groundwater Quality in the United Kingdom,
W83-00220 5E

Nitrate Contamination of Groundwater on the Old Mission Peninsula: Contribution of Land Reshaping and Septic Drainfields,
W83-00228 5B

The Laurel Run Acid Mine Drainage Renovation Demonstration Facility: An Evaluation,
W83-00258 5G

A Preliminary Study of Natural Aquifer Discharge of Guam,
W83-00271 5B

GROUNDWATER POTENTIAL
Geohydrology of Southwestern Kansas,
W83-00059 7C

GUAM
A Preliminary Study of Natural Aquifer Discharge of Guam,
W83-00271 5B

GULLS
The Incidence of Vibrio Cholerae in Water, Animals and Birds in Kent, England,
W83-00012 5B

HALOGENATED PESTICIDES
Differential Pulse Polarography of Some Herbicides Derived From 2,4-Dichlorophenoxyacetic Acid, II. Determination of Herbicide Residues in Irrigation Waters,
W83-00045 5A

HAWAII
Water Quality Simulation of Wahiawa Reservoir, O'Ahu, Hawaii,
W83-00281 5G

HAZARDOUS MATERIALS
Hazardous Pollutant Analysis in Water Using Infrared Spectroscopy,
W83-00231 5A

Hazardous Waste Technology Transfer Assessment,
W83-00276 5E

HAZARDS
Potential Flood and Debris Hazards at Cottonwood Cove, Lake Mead National Recreation Area, Clark County, Nevada,
W83-00070 2E

HEAVY METALS
Heavy Metals in Oysters and Clams of St. Louis Bay, Mississippi,
W83-00159 5C

Heavy Metal Interactions and Dynamics in Simulated Naugatuck River Microcosms,
W83-00214 5B

The Influence of Process Parameters on the Removal of Heavy Metals in Activated Sludge,
W83-00327 5D

HERBICIDES
Differential Pulse Polarography of Some Herbicides Derived From 2,4-Dichlorophenoxyacetic Acid, II. Determination of Herbicide Residues in Irrigation Waters,
W83-00045 5A

Aquatic Weed Control with Endothall in a Salt River Project Canal,
W83-00166 4A

The Ecological Effects of 2-Methylthiotriazine Herbicides used for Aquatic Weed Control in Navigable Canals, II. Effects on Macroinvertebrate Fauna, and General Discussion,
W83-00343 5C

HEXAGENIA
Effects of the Burrowing Mayfly, Hexagenia, on Nitrogen and Sulfur Fractions in Lake Sediment Microcosms,
W83-00030 5C

HIGH PERFORMANCE LIQUID CHROMATOGRAPHY
Determination of Pyrazon Residues in Water by Reversed Phase High Performance Liquid Chromatography,
W83-00014 5A

HIGHWAY ICING
Reevaluation of the Effects of Deicing Salt Runoff on a Small Urban Lake,
W83-00227 5C

HISTORY
Ho: For Reese River Natural Resources of the Toiyabe-Toquima Highlands, Central Nevada,
W83-00253 6B

HOLLOW FIBERS
Development of Composite Hollow Fibers - Phase III,
W83-00267 3A

HUMIC ACIDS
Adsorption of PAH to Aquatic Humus,
W83-00038 5B

Structural Characterization of Aquatic Humic Material,
W83-00190 5C

HUMUS SLUDGE
Algal Concentration and Species Composition in Experimental Maturation Ponds with Effects of Aeration and Recirculation,
W83-00284 5D

HURON RIVER
Association Studies of Polybrominated Biphenyls in Aquatic Systems,
W83-00160 5B

HYDRAULIC PROPERTIES
The Flow of Slurry from a Breached Tailings Dam,
W83-00285 8B

HYDRAULIC STRUCTURES
A Depth-Duration-Frequency Diagram for Point Rainfall in Swa-Namibia,
W83-00289 2B

HYDROELECTRIC PLANTS
Assessment of Low Head, Micro Hydroelectric Equipment for Use on Small Tropical Islands,
W83-00268 8C

Final Environmental Impact Statement of the White River Dam Project.
W83-00297 6G

HYDROELECTRIC POWER
Environmental Impact of Large Hydroelectric Projects on Tropical Countries,
W83-00010 6G

HYDROGEN ION CONCENTRATION
High pH Stabilization of Wastewater Sludge Using Chemical Softening Wastes From Water Treatment,
W83-00243 5D

Acidic Precipitation and Its Consequences for Aquatic Ecosystems: A Review,
W83-00331 5C

HYDROGEN SULFIDE
Comparison of Sulfide-Selective Electrode and Gas-Stripping Monitors for Hydrogen Sulfide in Effluents,
W83-00204 5A

HYDROGRAPH ANALYSIS
Adaptation of the ILLUDAS Model to a Desktop Computer,
W83-00081 7B

HYDROLOGIC ASPECTS
Soil Survey of the Experimental Catchments Near Bethlehem,
W83-00087 4D

Estimating Hydrologic Values for Planning Wildland Fire Protection,
W83-00306 6B

HYDROLOGIC BUDGET
Efficient Use of Water for Irrigation in the Upper Midwest,
W83-00242 3F

HYDROLOGIC CYCLE
The Role of Hydrologic Variability in Complying with Regulatory Enforcement Standards for the Rehabilitation of Surface-Mined Coal Lands,
W83-00223 6G

HYDROLOGIC DATA
Water Resources Data, Louisiana, Water Year 1981--Volume 2. Southern Louisiana.
W83-00057 7C

Geohydrology of Southwestern Kansas,
W83-00059 7C

Selected Hydrologic and Climatologic Data from the Prairie Dog Creek Basin, Southeastern Montana, Water Year 1980,
W83-00074 7C

HYDROLOGIC DATA

Selected Hydrogeologic Data from Southern Sweet Grass County, South-Central Montana,
W83-00076 7C

Hydrologic Data for Urban Storm Runoff from Nine Sites in the Denver Metropolitan Area, Colorado,
W83-00077 7C

Water Resources of the Rincon and Mesilla Valleys and Adjacent Areas, New Mexico,
W83-00078 7C

Hydrologic Data for Experimental Agricultural Watersheds in the United States, 1973,
W83-00095 7C

Water Resources Data for New York, Water Year 1981--Volume 3. Western New York.
W83-00131 7C

Water Resources Data for North Carolina, Water Year 1981.
W83-00132 7C

Assessment of the Usefulness of Hydrologic Data for Hydropower Feasibility Analysis,
W83-00251 2E

HYDROLOGIC MODELS

Use of Mathematical Models to Predict Impacts of Mining Energy Minerals on the Hydrologic System in Northwestern Colorado,
W83-00168 4C

Efficient Use of Water for Irrigation in the Upper Midwest,
W83-00242 3F

IIHR Distrubuted Parameter Watershed Model,
W83-00269 2E

HYDROLOGIC REGIME

Physicochemical Limnology of the Tongue River Reservoir, Montana,
W83-00033 2H

HYDROLOGIC SYSTEMS

Use of Mathematical Models to Predict Impacts of Mining Energy Minerals on the Hydrologic System in Northwestern Colorado,
W83-00168 4C

HYDROTHERMAL STUDIES

The Hydrothermal System in Southern Grass Valley, Pershing County, Nevada,
W83-00060 4B

ICE COVER

Instream Salmonid Habitat Exclusion by Ice-Cover,
W83-00257 8I

IDAHO

Predicting Sediment Yields from Sagebrush Rangelands,
W83-00106 4D

Assessment of the Usefulness of Hydrologic Data for Hydropower Feasibility Analysis,
W83-00251 2E

IIHR WATERSHED MODEL

IIHR Distrubuted Parameter Watershed Model,
W83-00269 2E

INDIA

Policy Objectives and Information System for Irrigation Projects-India,
W83-00011 6A

Seasonal Variation of Zooplankton of the Veli Lake, South-West Coast of India,
W83-00027 2H

INDUSTRIAL WASTEWATER

Trade Effluent Control and the Microprocessor,
W83-00003 5G

Textile Industry Wastewater Treatment by Air Flotation,
W83-00080 5D

Biooxidation of Paint Process Wastewater,
W83-00143 5D

Pulp and Paper Effluent Management,
W83-00164 5D

Primary Treatment.
W83-00337 5D

Municipal Pretreatment Program Development,
W83-00350 5D

INFORMATION EXCHANGE

Effective Graphical Display of Water Resource Planning Information for Decision Makers, Volume I,
W83-00273 10D

Effective Graphical Display of Water Resources Planning Information for Decision Makers, Volume II,
W83-00274 10D

INFRARED SPECTROSCOPY

Hazardous Pollutant Analysis in Water Using Infrared Spectroscopy,
W83-00231 5A

INHIBITORS

Development of New Chemical Additives and Treatments for Scale Control in Saline Water Evaporators,
W83-00222 3A

INJECTION WELLS

Hydrogeology and Results of Injection Tests at Waste-Injection Test Sites in Pinellas County, Florida,
W83-00129 5B

INSTITUTIONAL CONSTRAINTS

Case Study Analyses of 208 Program Effectiveness in Improving Regional Water Resources Management,
W83-00240 6B

Wastewater Management Problems in Rural Communities,
W83-00249 5G

Analysis of Legal and Institutional Arrangements Affecting Water Allocation and Use in Nebraska,
W83-00250 6E

INTAKES

Water Supply and Treatment, Section C-1, Raw Water Preparation.
W83-00335 5F

INTERAGENCY COOPERATION

U.S. Geological Survey Federal-State Program,
W83-00201 6E

INTERNATIONAL LAW

The Plight of American Citizens Injured by Transboundary River Pollution,
W83-00209 6E

INTERSTATE COMPACTS

Report of the Annual Yield of the Arkansas River Basin for the Arkansas River Basin Compact, Arkansas--Oklahoma, 1980 Water Year,
W83-00063 4A

INVERTEBRATES

Seasonal Variation of Zooplankton of the Veli Lake, South-West Coast of India,
W83-00027 2H

Littoral and Profundal Macroinvertebrate Communities of a Coastal Brown-Water Lake,
W83-00044 2H

Some Aspects of the Colonization by Water Mites (Acari, Actinedida) of an Artifical Substrate in a Disturbed Environment,
W83-00054 5C

ION EXCHANGE

Preparation of Thin-Ion-Exchange Membranes with Exceptionally Low Resistances and High Selectivities.
W83-00261 3A

IONS

Seasonal Mass Balance of Major Ions in Three Small Watersheds in a Maritime Environment,
W83-00323 2K

IOWA

Soil Characterization and Alternate Shoreline Erosion Control Measures for Constructed Lakes in Iowa,
W83-00218 4D

Rural Water Supply Systems: Improved Planning Strategies Through Systems Analysis,
W83-00241 6A

Application to the Des Moines River of Multiple Reservoir Operating Strategies Incorporating Short-and Long-Term Information in Real Time,
W83-00248 4A

IIHR Distrubuted Parameter Watershed Model,
W83-00269 2E

IRON

Determination of Iron in Natural Waters and Plant Material with 1,10-Phenanthroline by Flow Injection Analysis,
W83-00194 5A

Softening, Iron and Manganese Removal.
W83-00342 5F

IRRIGATION

Water Saving Techniques,
W83-00309 3F

Conservation Through Crops Research,
W83-00311 3F

IRRIGATION EFFECTS

Non-Point Pollution Control for Rangeland Wintering, Livestock Operations (Ground Cover),
W83-00252 5G

Conservation Through Crops Research,
W83-00311 3F

IRRIGATION EFFICIENCY

The Probability Distribution of Water Inputs and the Economic Benefits of Supplementary Irrigation,
W83-00016 6A

Efficient Use of Water for Irrigation in the Upper Midwest,
W83-00242 3F

Water Saving Techniques,
W83-00309 3F

Irrigation Scheduling,
W83-00310 3F

IRRIGATION PRACTICES

Policy Objectives and Information System for Irrigation Projects-India,
W83-00011 6A

Variability in Crop Physiological and Morphological Characteristics Controlling Water Use Efficiency and Grain Yield,
W83-00234 3F

Water-Use Production Functions of Selected Agronomic Crops in Northwestern New Mexico, Phase I,
W83-00235 3F

Incentives for Irrigation Water Conservation in Agriculture,
W83-00278 3F

A Weighing Lysimeter Facility at Roodeplaat for Crop Evapotranspiration Studies,
W83-00287 2D

Irrigation Scheduling,
W83-00310 3F

IRRIGATION PROGRAMS
Irrigation Planning in the Tana Basin of Kenya,
W83-00015 6B

IRRIGATION SCHEDULING
Irrigation Scheduling,
W83-00310 3F

IRRIGATION WATER
Differential Pulse Polarography of Some Herbicides Derived From 2,4-Dichlorophenoxyacetic Acid, II. Determination of Herbicide Residues in Irrigation Waters,
W83-00045 5A

Incentives for Irrigation Water Conservation in Agriculture,
W83-00278 3F

ISOTOPE FRACTIONATION
Factors Controlling Stable Isotope Composition of European Precipitation,
W83-00176 2B

ISOTOPE STUDIES
Factors Controlling Stable Isotope Composition of European Precipitation,
W83-00176 2B

ISRAEL
The Relationship Between Nutrient Status and Chemical Composition of Peridinium Cinctum During the Bloom in Lake Kinneret,
W83-00333 5C

JAPAN
Distribution of Denitrifying Bacteria and its Controlling Factors in Freshwater Environments,
W83-00018 5C

Nitrogen Metabolism in Lake Kizaki, Japan. III. Active Nitrification in Early Summer,
W83-00040 2H

Nitrogen Metabolism in Lake Kizaki, Japan I. Ammonium and Nitrate Uptake by Phytoplankton,
W83-00344 2H

Nitrogen Metabolism in Lake Kizaki, Japan II. Distribution and Decomposition of Organic Nitrogen,
W83-00345 2H

KENTUCKY
Groundwater in the Inner Bluegrass Karst Region, Kentucky,
W83-00275 2F

KENYA
Irrigation Planning in the Tana Basin of Kenya,
W83-00015 6B

Species Composition and Distribution of Zooplankton in a Tropical Lake, Lake Naivasha, Kenya,
W83-00056 5B

KIELDER DAM
Kielder - Planning to Meet the Future.
W83-00207 8A

KINETIC ENERGY
The Spatial Distribution in Southern Africa of Rainfall Erosivity for Use in the Universal Soil Loss Equation,
W83-00140 2J

KINETICS
A Simulation Study on the Operation of Laboratory Scale Anaerobic Digesters,
W83-00138 5D

Mineralization of Linear Alcohol Ethoxylates and Linear Alcohol Ethoxy Sulfates at Trace Concentrations in Estuarine Water,
W83-00211 5B

LABORATORY EQUIPMENT
Operation Control.
W83-00155 5G

Metering, Monitoring and Quality Control.
W83-00336 8G

LAKE CONSTANCE
The Structure and Some Recent Changes of the Zoobenthic Community in the Ermatinger Becken, A Shallow Littoral Part of Lake Constance,
W83-00036 2H

LAKE KINNERET
The Relationship Between Nutrient Status and Chemical Composition of Peridinium Cinctum During the Bloom in Lake Kinneret,
W83-00333 5C

LAKE KIZAKI
Nitrogen Metabolism in Lake Kizaki, Japan I. Ammonium and Nitrate Uptake by Phytoplankton,
W83-00344 2H

Nitrogen Metabolism in Lake Kizaki, Japan II. Distribution and Decomposition of Organic Nitrogen,
W83-00345 2H

LAKE MICHIGAN
Association Studies of Polybrominated Biphenyls in Aquatic Systems,
W83-00160 5B

LAKE MORPHOLOGY
Reevaluation of the Effects of Deicing Salt Runoff on a Small Urban Lake,
W83-00227 5C

LAKE RESTORATION
Existence of Phytoplankton in Spirit Lake Near Active Volcano Mt. St. Helens, Washington, U.S.A.: Post-Eruption Findings,
W83-00026 5C

Lake Restoration Technology Transfer Assessment,
W83-00215 5G

An Evaluation of the Recovery of Adirondack Acid Lakes by Chemical Manipulation,
W83-00245 5G

Evaluation of Limnological Parameters as Related to the Success of Mysis Relicta Introductions,
W83-00254 8I

Stratigaphic Diatom and Chemical Evidence for Acid Strip-Mine Lake Recovery,
W83-00329 2H

LAKE SEDIMENTS
Control of Lake Phosphorus with Aluminum Sulfate: Dose Determination and Application Techniques,
W83-00006 5C

Paleoecological Studies of the Recent Development of the Lake Vaxjosjon. IV. Interpretation of the Eutrophication Process Through the Analysis of Subfossil Chironomids,
W83-00028 5C

Effects of the Burrowing Mayfly, Hexagenia, on Nitrogen and Sulfur Fractions in Lake Sediment Microcosms,
W83-00030 5C

Littoral and Profundal Macroinvertebrate Communities of a Coastal Brown-Water Lake,
W83-00044 2H

The Sediments of the New Artificial Lake Bostalsee (Saarland, Germany), with Particular Reference to Microbial Activity,
W83-00048 5C

Heavy Metal Interactions and Dynamics in Simulated Naugatuck River Microcosms,
W83-00214 5B

Paleolimnology of Lake Isle, Alberta, Canada (Including Sediment Chemistry, Pigments and Diatom Stratigraphy),
W83-00316 2H

LAKE SHORES
Soil Characterization and Alternate Shoreline Erosion Control Measures for Constructed Lakes in Iowa,
W83-00218 4D

LAKE TAHOE
In Situ Response of Phytoplankton Fluorescence to Rapid Variations in Light,
W83-00141 5C

LAKE WESTEINDER
Phosphate and Wind in a Shallow Lake,
W83-00184 5B

LAKES
Investigations on the Lakes of Peru and Their Phytoplankton. 6 Additional Chemical Analyses,
W83-00037 2H

Bacterioplankton Affected by Phosphorus Precipitation Treatment in a Polytrophic Lake,
W83-00315 5G

Use of the Water-Salt Balance Method for Calculating the Desalination Regime of a Large Water Body,
W83-00322 5G

The Relationship Between Nutrient Status and Chemical Composition of Peridinium Cinctum During the Bloom in Lake Kinneret,
W83-00333 5C

LAMBERT-BEER'S LAW
Components Contributing to Light Extinction in Natural Water: Method of Isolation,
W83-00213 5A

LAND DISPOSAL
The Effects of the Disposal of Sewage Effluents on Groundwater Quality in the United Kingdom,
W83-00220 5E

Land Application of Municipal Sludge with Regard to Cropping Systems and Pollution Potential,
W83-00233 5E

Hazardous Waste Technology Transfer Assessment,
W83-00276 5E

Spreading Lagooned Sewage Sludge on Farmland: A Case History,
W83-00296 5E

LAND FORMING
Nitrate Contamination of Groundwater on the Old Mission Peninsula: Contribution of Land Reshaping and Septic Drainfields,
W83-00228 5B

LAND MANAGEMENT
Climatic Aspects of Droughts,
W83-00188 3F

LAND RECLAMATION
The Role of Hydrologic Variability in Complying with Regulatory Enforcement Standards for the Rehabilitation of Surface-Mined Coal Lands,
W83-00223 6G

LAND USE
Investigation of Trends in Flooding in the Tug Fork Basin of Kentucky, Virginia, and West Virginia,
W83-00128 4A

Ho: For Reese River Natural Resources of the Toiyabe-Toquima Highlands, Central Nevada,
W83-00253 6B

LANDFILLS
Solid Waste Management in South Africa,
W83-00090 5G

Multiple Purge Techniques for Determining Organic Pollutants in Groundwater,
W83-00158 5A

Geologic Criteria in Waste-Management Site Selection in Northeastern North Dakota,
W83-00236 5E

LANDSAT DATA
Remote Sensing of Water Resources on Pacific Islands,
W83-00262 7C

LEACHATES
Anaerobic Digestion of Free Volatile Fatty Acids in Soils Below Waste Tips,
W83-00326 5D

LEAD
Improvements in Foam Flotation for Lead Removal,
W83-00150 5D

LEAKAGE
Sewer Maintenance and Rehabilitation.
W83-00156 5D

A New Method of Leak Detection in Distribution Systems Under Pressure: Acoustic Correlation,
W83-00205 8G

System Maintenance.
W83-00339 8A

LEGAL ASPECTS
The Plight of American Citizens Injured by Transboundary River Pollution,
W83-00209 6E

The Role of Hydrologic Variability in Complying with Regulatory Enforcement Standards for the Rehabilitation of Surface-Mined Coal Lands,
W83-00223 6G

Analysis of Legal and Institutional Arrangements Affecting Water Allocation and Use in Nebraska,
W83-00250 6E

Water Law Primer,
W83-00318 6E

LIABILITY
The Plight of American Citizens Injured by Transboundary River Pollution,
W83-00209 6E

LIGHT INTENSITY
In Situ Response of Phytoplankton Fluorescence to Rapid Variations in Light,
W83-00141 5C

LIGHT PENETRATION
The Development of Attenuance Depth-Profiling to Follow the Changing Distribution of Phytoplankton and Other Particulate Material in a Productive English Lake,
W83-00055 5C

Components Contributing to Light Extinction in Natural Water: Method of Isolation,
W83-00213 5A

LIME
The Characterization and Processing of Lime Sludges from Water Reclamation Plants,
W83-00086 5D

LIMNOLOGY
Evaluation of Limnological Parameters as Related to the Success of Mysis Relicta Introductions,
W83-00254 8I

LINEAR PROGRAMMING
Application to the Des Moines River of Multiple Reservoir Operating Strategies Incorporating Short-and Long-Term Information in Real Time,
W83-00248 4A

LITERATURE REVIEW
Nutrient Removal From Wastewater by Wetlands,
W83-00226 5D

Ho: For Reese River Natural Resources of the Toiyabe-Toquima Highlands, Central Nevada,
W83-00253 6B

Acidic Precipitation and Its Consequences for Aquatic Ecosystems: A Review,
W83-00331 5C

LITERATURE REVIEWS
Guidelines for Surface Water Quality: Vol 1: Inorganic Chemical Substances: Copper,
W83-00079 5G

Water Reclamation and Reuse,
W83-00163 5D

Pulp and Paper Effluent Management,
W83-00164 5D

Law,
W83-00165 6E

Water Characteristics,
W83-00169 5B

LITTER
Runoff and Sedimentation Potentials Influenced by Litter and Slope on a Chaparral Community in Central Arizona,
W83-00301 4D

LITTORAL ZONE
Distribution of Chironomids in the Littoral Zone of Lake Texoma, Oklahoma and Texas,
W83-00031 2H

Littoral and Profundal Macroinvertebrate Communities of a Coastal Brown-Water Lake,
W83-00044 2H

LIVESTOCK
Rural Water Supply Systems: Improved Planning Strategies Through Systems Analysis,
W83-00241 6A

Non-Point Pollution Control for Rangeland Wintering, Livestock Operations (Ground Cover),
W83-00252 5G

LOUISIANA
Water Resources Data, Louisiana, Water Year 1981--Volume 2. Southern Louisiana.
W83-00057 7C

Applications of Digital Modeling for Evaluating the Ground-Water Resources of the '2,000-Foot' Sand of the Baton Rouge Area, Louisiana,
W83-00109 4B

LOW FLOW
Low-Flow Characteristics and Flow Duration of New Jersey Streams,
W83-00061 7C

Low Flow of Streams in Fairfax County, Virginia,
W83-00062 4C

LYSIMETERS
A Weighing Lysimeter Facility at Roodeplaat for Crop Evapotranspiration Studies,
W83-00287 2D

MACROINVERTEBRATES
Littoral and Profundal Macroinvertebrate Communities of a Coastal Brown-Water Lake,
W83-00044 2H

The Ecological Effects of 2-Methylthiotriazine Herbicides used for Aquatic Weed Control in Navigable Canals, II. Effects on Macroinvertebrate Fauna, and General Discussion,
W83-00343 5C

MAINTENANCE
Sewer Maintenance and Rehabilitation.
W83-00156 5D

Control Operations and Maintenance Services.
W83-00157 5D

System Maintenance.
W83-00339 8A

MANAGEMENT PLANNING
Policy Objectives and Information System for Irrigation Projects-India,
W83-00011 6A

Effective Graphical Display of Water Resource Planning Information for Decision Makers, Volume I,
W83-00273 10D

Effective Graphical Display of Water Resources Planning Information for Decision Makers, Volume II,
W83-00274 10D

MANGANESE
Softening, Iron and Manganese Removal.
W83-00342 5F

MANGROVE SWAMPS
The Ecology of the Mangroves of South Florida: A Community Profile,
W83-00093 6G

MAPS
Map Showing the Potentiometric Surface of the Magothy Aquifer in Southern Maryland, September 1981,
W83-00115 7C

Soil Maps of Montana,
W83-00237 7C

MARSHES
The Effects of Excessive Nitrogen and Phosphorus in Surface Waters of a Prairie Marsh,
W83-00266 5G

MARYLAND
Carroll County Ground-Water Information: Well Records, Spring Records, and Chemical-Quality Data.
W83-00058 7C

Map Showing the Potentiometric Surface of the Magothy Aquifer in Southern Maryland, September 1981,
W83-00115 7C

MASSACHUSETTS
New EPA Sodium and Corrosion Regulations: Their Basis and Impacts,
W83-00137 5G

Seasonal Changes of Dissolved Sodium in the Connecticut River Near Northfield, Massachusetts,
W83-00139 5B

MATERIALS ENGINEERING
Plastics Give 20 Years Life-Span - with Virtually Zero Maintenance.
W83-00008 8G

MATHEMATICAL EQUATIONS
Water-Use Production Functions of Selected Agronomic Crops in Northwestern New Mexico, Phase I,
W83-00235 3F

Instream Salmonid Habitat Exclusion by Ice-Cover,
W83-00257 8I

Pine Tree Evapotranspiration,
W83-00279 2D

Adjustment of Soil Limitations,
W83-00286 2G

MATHEMATICAL MODELS
Estimating Runoff Volumes from Urban Areas,
W83-00007 4A

The Probability Distribution of Water Inputs and the Economic Benefits of Supplementary Irrigation,
W83-00016 6A

Use of Erosion Models on Western Rangelands,
W83-00097 2J

Special Problems in the Application of the USLE to Rangelands: C and P Factors,
W83-00100 2J

Estimating Sediment Yield from Rangeland with CREAMS,
W83-00103 2J

Modeling Erosion in Overland Flow,
W83-00104 4D

Predicting Sediment Yields from Sagebrush Rangelands,
W83-00106 4D

Testing the Modified Universal Soil Loss Equation,
W83-00107 4D

Developing a USLE Cover-Management (C) Factor Procedure for Forest Conditions,
W83-00108 4D

Factors Controlling Stable Isotope Composition of European Precipitation,
W83-00176 2B

Soil Characterization and Alternate Shoreline Erosion Control Measures for Constructed Lakes in Iowa,
W83-00218 4D

The Flow of Slurry from a Breached Tailings Dam,
W83-00285 8B

Persistence in Model Ecosystems,
W83-00294 5B

MATHEMATICAL STUDIES
Lump Sum Tax Loss Reimbursement Under the Thames River Flood Control Compact,
W83-00005 6B

The Analyses of Areal Rainfall Using Multi-Quadric Surfaces,
W83-00088 2B

Reservoir Management in Potomac River Basin,
W83-00203 6A

Stochastic Daily Precipitation Modeling and Daily Streamflow Transfer Processes,
W83-00282 2E

MAYFLIES
Effects of the Burrowing Mayfly, Hexagenia, on Nitrogen and Sulfur Fractions in Lake Sediment Microcosms,
W83-00030 5C

MEASURING INSTRUMENTS
A New Method of Leak Detection in Distribution Systems Under Pressure: Acoustic Correlation,
W83-00205 8G

MEAT PROCESSING INDUSTRY
Water and Waste Management in the Canadian Meat and Poultry Processing Industry.
W83-00082 3E

MECHANICAL EQUIPMENT
Advanced Treatment.
W83-00151 5D

Operation Control.
W83-00155 5G

Development and Demonstration of a Reverse-Osmosis Energy-Recovery Device,
W83-00256 3A

MEMBRANE PROCESSES
Hydrodynamics and Fouling of Pressure Driven Membrane Desalination and Water Treatment Systems,
W83-00244 3A

Development of Chlorine Resistant Membranes, Polyimide Membranes and Porous Substrates,
W83-00246 3A

A Study of Glow Discharge Polymerization as a Means of Preparing Composite Reverse Osmosis Membranes with Ultrathin Skin,
W83-00260 3A

Development of Composite Hollow Fibers - Phase III,
W83-00267 3A

MEMBRANES
Development of Chlorine Resistant Membranes, Polyimide Membranes and Porous Substrates,
W83-00246 3A

A Study of Glow Discharge Polymerization as a Means of Preparing Composite Reverse Osmosis Membranes with Ultrathin Skin,
W83-00260 3A

Preparation of Thin-Ion-Exchange Membranes with Exceptionally Low Resistances and High Selectivities.
W83-00261 3A

MERCURY
Recycling of Mercury and Silver from COD Tests,
W83-00145 5D

Pre-Concentration Technique for Cold-Vapour Atomic-Fluorescence Determination of Mercury in Drinking Waters,
W83-00195 5A

MEROMICTIC LAKES
An Integrated Study on Littoral and Pelagic Primary Production in a Southern African Coastal Lake,
W83-00053 5C

MESOTROPHIC LAKES
Nitrogen Metabolism in Lake Kizaki, Japan I. Ammonium and Nitrate Uptake by Phytoplankton,
W83-00344 2H

METROPOLITAN WATER MANAGEMENT
Reservoir Management in Potomac River Basin,
W83-00203 6A

MICHIGAN
Phytoplankton Contribution to Alkaline Phosphatase Activity,
W83-00041 2H

MICROBIAL DEGRADATION
Microorganisms Capable of Degrading Refractory Hydrocarbons in Ohio Waters,
W83-00219 5B

MICROORGANISMS
Aerobic Degradation of Diuron by Aquatic Microorganisms,
W83-00002 5B

MIDGES
Paleoecological Studies of the Recent Development of the Lake Vaxjosjon. IV. Interpretation of the Eutrophication Process Through the Analysis of Subfossil Chironomids,
W83-00028 5C

Distribution of Chironomids in the Littoral Zone of Lake Texoma, Oklahoma and Texas,
W83-00031 2H

MIDWEST U.S.
Efficient Use of Water for Irrigation in the Upper Midwest,
W83-00242 3F

MINE WASTES
Water Management in the Oil Shale Industry,
W83-00185 5D

The Flow of Slurry from a Breached Tailings Dam,
W83-00285 8B

MINERAL SPRINGS
Chemical and Isotopic Composition of Water from Thermal and Mineral Springs of Washington,
W83-00112 2K

MINERALIZATION
The Aerobic Mineralization of Amino Acids in the Saline Lake Grevelingen and the Freshwater Haringvliet Basin (The Netherlands),
W83-00178 5C

Mineralization of Linear Alcohol Ethoxylates and Linear Alcohol Ethoxy Sulfates at Trace Concentrations in Estuarine Water,
W83-00211 5B

MINERALOGY
Water-Quality Characteristics of Six Small, Semiarid Watersheds in the Green River Coal Region of Colorado,
W83-00124 5A

MINING INDUSTRY
Use of Mathematical Models to Predict Impacts of Mining Energy Minerals on the Hydrologic System in Northwestern Colorado,
W83-00168 4C

MINNESOTA
Designation of Principal Water-Supply Aquifers in Minnesota,
W83-00125 2F

MISSISSIPPI
Heavy Metals in Oysters and Clams of St. Louis Bay, Mississippi,
W83-00159 5C

MISSOURI RIVER BASIN
Perennial-Streamflow Characteristics Related to Channel Geometry and Sediment in Missouri River Basin,
W83-00121 4D

MODEL STUDIES
Mass Balance Model Estimation of Phosphorus Concentrations in Reservoirs,
W83-00009 5C

Applicability of Phosphorus Budget Models to Southern African Man-Made Lakes,
W83-00025 5C

Use of Rainfall Simulators to Determine Parameters for Erosion Prediction,
W83-00102 2J

The Role of Hydrologic Variability in Complying with Regulatory Enforcement Standards for the Rehabilitation of Surface-Mined Coal Lands,
W83-00223 6G

Water Resource System Reliability Under Drought Conditions: The Seattle Water Supply System as a Case Study,
W83-00229 3D

Hydrodynamics and Fouling of Pressure Driven Membrane Desalination and Water Treatment Systems,
W83-00244 3A

Incentives for Irrigation Water Conservation in Agriculture,
W83-00278 3F

MONITORING
Water Quality of Streams in the Great Smoky Mountains National Park,
W83-00032 5B

Plumbline Monitor Interface,
W83-00094 8G

Chemical Surveillance of Rivers,
W83-00134 5A

Water Quality in Urban Streams--What we can Expect,
W83-00144 5C

An Overview of Acid Rain Monitoring Activities in North America,
W83-00189 5C

Accuracy of Determination of Ammoniacal Nitrogen in River Waters: Analytical Quality Control in the Harmonised Monitoring Scheme.
W83-00196 5A

Intensive Flow Monitoring--Cost-Effectiveness with a Quality Edge,
W83-00200 5G

Comparison of Sulfide-Selective Electrode and Gas-Stripping Monitors for Hydrogen Sulfide in Effluents,
W83-00204 5A

Practical Techniques of River Monitoring and Pollution Forecasting,
W83-00238 5B

Irrigation Scheduling,
W83-00310 3F

Design of Monitoring Studies for Priority Pollutants,
W83-00321 7A

Metering, Monitoring and Quality Control.
W83-00336 8G

Municipal Pretreatment Program Development,
W83-00350 5D

MONTANA
Physicochemical Limnology of the Tongue River Reservoir, Montana,
W83-00033 2H

Annual Peak Discharges from Small Drainage Areas in Montana Through September 1981,
W83-00071 2E

Selected Hydrologic and Climatologic Data from the Prairie Dog Creek Basin, Southeastern Montana, Water Year 1980,
W83-00074 7C

Selected Hydrogeologic Data from Southern Sweet Grass County, South-Central Montana,
W83-00076 7C

Soil Maps of Montana,
W83-00237 7C

MOUNTAIN LAKES
An Evaluation of the Recovery of Adirondack Acid Lakes by Chemical Manipulation,
W83-00245 5G

MOUNTAINS
Measurement and Mapping of Potential Evapotranspiration in a Small Mountainous Watershed,
W83-00346 2D

Rainfall-Runoff Characteristics for a Mountainous Watershed in the Northeast United States,
W83-00347 2A

MT. ST. HELENS
Existence of Phytoplankton in Spirit Lake Near Active Volcano Mt. St. Helens, Washington, U.S.A.: Post-Eruption Findings,
W83-00026 5C

Characterization of Organic Contaminants in Environmental Samples Associated with Mount St. Helens 1980 Volcanic Eruption,
W83-00161 5A

MULTIVARIATE ANALYSIS
A Principal Components Analysis of the Phytoplankton from a Pond in the Parana River Valley, Argentina,
W83-00022 5C

MUNICIPAL WASTES
Land Application of Municipal Sludge with Regard to Cropping Systems and Pollution Potential,
W83-00233 5E

MUNICIPAL WASTEWATER
Effects of Michigan's Phosphorus Detergent Ban on Municipal Chemical Costs,
W83-00147 5G

MUNICIPAL WATER
The Water Supply of the Brussels Urban Area and its Surroundings.
W83-00020 5F

MUSSELS
Polynuclear Aromatic Hydrocarbons and Cellular Proliferative Disorders in Bivalue Molluscs from Oregon Estuaries,
W83-00295 5C

NAMIBIA
A Depth-Duration-Frequency Diagram for Point Rainfall in Swa-Namibia,
W83-00289 2B

NASQAN
A Study of Trends in Total Phosphorus Measurements at Nasqan Stations,
W83-00126 5B

NATURAL RESOURCES
The Ecology of the Mangroves of South Florida: A Community Profile,
W83-00093 6G

NATURAL STREAMS
Water Quality of Streams in the Great Smoky Mountains National Park,
W83-00032 5B

NAUGATUCK RIVER
Heavy Metal Interactions and Dynamics in Simulated Naugatuck River Microcosms,
W83-00214 5B

NEBRASKA
Large-Scale Bedforms in the Platte River Downstream from Grand Island, Nebraska: Structure Process, and Relationship to Channel Narrowing,
W83-00111 4D

Analysis of Legal and Institutional Arrangements Affecting Water Allocation and Use in Nebraska,
W83-00250 6E

NEUTRALIZATION
An Evaluation of the Recovery of Adirondack Acid Lakes by Chemical Manipulation,
W83-00245 5G

NEVADA
The Hydrothermal System in Southern Grass Valley, Pershing County, Nevada,
W83-00060 4B

Potential Flood and Debris Hazards at Cottonwood Cove, Lake Mead National Recreation Area, Clark County, Nevada,
W83-00070 2E

Ho: For Reese River Natural Resources of the Toiyabe-Toquima Highlands, Central Nevada,
W83-00253 6B

NEW ENGLAND REGION
Summary Appraisals of the Nation's Ground-Water Resources--New England Region,
W83-00120 4B

NEW HAMPSHIRE
Design and Construction of the Pennichuck Water Treatment Plant: The Engineer's View,
W83-00135 5F

Design and Construction of the Pennichuck Water Treatment Plant: The Construction Manager's View,
W83-00136 5F

NEW JERSEY
Low-Flow Characteristics and Flow Duration of New Jersey Streams,
W83-00061 7C

NEW MEXICO
Water-Resources Investigations of the U.S. Geological Survey in New Mexico, Fiscal Year 1980.
W83-00073 7A

Water Resources of the Rincon and Mesilla Valleys and Adjacent Areas, New Mexico,
W83-00078 7C

The USLE Rainfall Factor for Southwestern U. S. Rangelands,
W83-00098 4D

Water-Use Production Functions of Selected Agronomic Crops in Northwestern New Mexico, Phase I,
W83-00235 3F

Water Treatment for Small Public Supplies,
W83-00280 5F

High Plains-Ogallala Aquifer Study, New Mexico -- Economic Impacts,
W83-00308 6B

Water Saving Techniques,
W83-00309 3F

Conservation Through Crops Research,
W83-00311 3F

NEW YORK
Effects of the Burrowing Mayfly, Hexagenia, on Nitrogen and Sulfur Fractions in Lake Sediment Microcosms,
W83-00030 5C

Geohydrology of the Valley-Fill Aquifer in the South Fallsburgh-Woodbourne Area, Sullivan County, New York,
W83-00069 7C

Geohydrology of the Valley-Fill Aquifer in the Schenectady Area, Schenectady County, New York,
W83-00116 7C

Geohydrology of the Valley-Fill Aquifer in the Corning Area, Steuben County, New York,
W83-00117 7C

Water Resources Data for New York, Water Year 1981--Volume 3. Western New York.
W83-00131 7C

NITRATES
Nitrogen Metabolism in Lake Kizaki, Japan. III. Active Nitrification in Early Summer,
W83-00040 2H

Nitrate Contamination of Groundwater on the Old Mission Peninsula: Contribution of Land Reshaping and Septic Drainfields,
W83-00228 5B

Stream Water Nutrient Changes Associated with the Conversion of Arizona Chaparral,
W83-00300 5B

Nitrogen Metabolism in Lake Kizaki, Japan I. Ammonium and Nitrate Uptake by Phytoplankton,
W83-00344 2H

NITRIFICATION
Nitrogen Metabolism in Lake Kizaki, Japan. III. Active Nitrification in Early Summer,
W83-00040 2H

NITROGEN
The Effects of Excessive Nitrogen and Phosphorus in Surface Waters of a Prairie Marsh,
W83-00266 5G

NITROGEN COMPOUNDS
Effects of the Burrowing Mayfly, Hexagenia, on Nitrogen and Sulfur Fractions in Lake Sediment Microcosms,
W83-00030 5C

Nitrogen Metabolism in Lake Kizaki, Japan II. Distribution and Decomposition of Organic Nitrogen,
W83-00345 2H

NITROGEN REMOVAL
Nutrient Removal From Wastewater by Wetlands,
W83-00226 5D

NONPOINT POLLUTION SOURCES
Non-Point Pollution Control for Rangeland Wintering, Livestock Operations (Ground Cover),
W83-00252 5G

NORTH AMERICA
Transport of Organic Carbon to the Oceans by Rivers of North America: A Synthesis of Existing Data,
W83-00174 5B

An Overview of Acid Rain Monitoring Activities in North America,
W83-00189 5C

NORTH CAROLINA
Municipal Point Source and Agricultural Nonpoint Source Contribution to Coastal Eutrophication,
W83-00001 5B

Manual for Leveling at Gaging Stations in North Carolina,
W83-00065 7B

Water Resources Data for North Carolina, Water Year 1981.
W83-00132 7C

Water Quality in Urban Streams--What we can Expect,
W83-00144 5C

NORTH DAKOTA
Geologic Criteria in Waste-Management Site Selection in Northeastern North Dakota,
W83-00236 5E

NOVA SCOTIA
Seasonal Mass Balance of Major Ions in Three Small Watersheds in a Maritime Environment,
W83-00323 2K

NUISANCE ALGAE
Control of Lake Phosphorus with Aluminum Sulfate: Dose Determination and Application Techniques,
W83-00006 5C

NUTRIENT REMOVAL
Nutrient Removal From Wastewater by Wetlands,
W83-00226 5D

Advanced Biological Treatment to Achieve Nutrient Removal,
W83-00349 5D

NUTRIENT REQUIREMENTS
The Relationship Between Nutrient Status and Chemical Composition of Peridinium Cinctum During the Bloom in Lake Kinneret,
W83-00333 5C

NUTRIENTS
Physicochemical Limnology of the Tongue River Reservoir, Montana,
W83-00033 2H

Seasonal Abundance of Ceratium Hirundinella, (O.F. Muller) Schrank in Lakes of Different Trophy,
W83-00052 5C

Anoxic Nutrient Regeneration and the Eutrophication of Estuarine Waters,
W83-00263 5C

Influence of Prescribed Burning on Nutrient Budgets of Mountain Fynbos Catchments in the S. W. Cape, Rep. of South Africa,
W83-00304 5B

OBSERVATION WELLS
Installation and Sampling of Observation Wells and Analyses of Water from the Shallow Aquifer at Selected Waste-Disposal Sites in the Memphis Area, Tennessee,
W83-00066 5B

Map Showing the Potentiometric Surface of the Magothy Aquifer in Southern Maryland, September 1981,
W83-00115 7C

OCEAN DUMPING
Water Quality Criteria and Effluent Requirements in Broward County, Florida,
W83-00320 5G

ODOR CONTROL
Disinfection, Odor Prevention and Control.
W83-00154 5D

Disinfection, Taste and Odor Control.
W83-00341 5F

OGALLALA AQUIFER
The Ogallala--Half Full or Half Empty.,
W83-00017 6D

High Plains-Ogallala Aquifer Study, New Mexico -- Economic Impacts,
W83-00308 6B

High Plains - Ogallala Aquifer Study Water Transfer Element,
W83-00312 4A

OHIO
Floodflow Characteristics Related to Channel Geometry in Ohio,
W83-00067 2E

Microorganisms Capable of Degrading Refractory Hydrocarbons in Ohio Waters,
W83-00219 5B

Stratigaphic Diatom and Chemical Evidence for Acid Strip-Mine Lake Recovery,
W83-00329 2H

OIL FIELDS
Methods for Collection and Analysis of Geopressured Geothermal and Oil Field Waters,
W83-00127 2K

OIL SHALE
Water Management in the Oil Shale Industry,
W83-00185 5D

OILY WATER
Treatment of Oily Wastewaters from Onshore Operations,
W83-00319 5D

OKLAHOMA
Distribution of Chironomids in the Littoral Zone of Lake Texoma, Oklahoma and Texas,
W83-00031 2H

Report of the Annual Yield of the Arkansas River Basin for the Arkansas River Basin Compact, Arkansas--Oklahoma, 1980 Water Year,
W83-00063 4A

Hydrologic Data for the Alluvium and Terrace Aquifer of the Beaver-North Canadian River from the Panhandle to Canton Reservoir, Northwestern Oklahoma,
W83-00110 7C

OLIGOCHAETES
Some Notes on the Ecology of Aquatic Oligochaetes in the Delta Region of the Netherlands,
W83-00035 2L

OLIGOTROPHIC LAKES
Seasonal Abundance of Ceratium Hirundinella, (O.F. Muller) Schrank in Lakes of Different Trophy,
W83-00052 5C

ONTARIO
Improvements in Quantifying the Phosphorus Concentration in Lake Water,
W83-00208 5C

OPTIMIZATION
Application to the Des Moines River of Multiple Reservoir Operating Strategies Incorporating Short-and Long-Term Information in Real Time,
W83-00248 4A

OPTIMUM DEVELOPMENT PLANS
Case Study Analyses of 208 Program Effectiveness in Improving Regional Water Resources Management,
W83-00240 6B

Rural Water Supply Systems: Improved Planning Strategies Through Systems Analysis,
W83-00241 6A

OREGON
Polynuclear Aromatic Hydrocarbons and Cellular Proliferative Disorders in Bivalue Molluscs from Oregon Estuaries,
W83-00295 5C

ORGANIC CARBON
Dissolved Organic Carbon and UV-Absorption in a Polluted Lowland Brook-Pond System,
W83-00024 5G

Transport of Organic Carbon to the Oceans by Rivers of North America: A Synthesis of Existing Data,
W83-00174 5B

ORGANIC COMPOUNDS
Determination of Organophosphorus and Organosulphur at the Sub-NG-Level for Use in Water Analysis,
W83-00046 5A

Characterization of Organic Contaminants in Environmental Samples Associated with Mount St. Helens 1980 Volcanic Eruption,
W83-00161 5A

Control Measures for Groundwater VOCS,
W83-00199 5F

Determination of Organic Contaminants in Ultra-Pure Water by Reversed-Phase High-Performance Liquid Chromatography with Ultraviolet Detection,
W83-00202 5A

Microorganisms Capable of Degrading Refractory Hydrocarbons in Ohio Waters,
W83-00219 5B

Hazardous Pollutant Analysis in Water Using Infrared Spectroscopy,
W83-00231 5A

ORGANIC LOADING
Multiple Purge Techniques for Determining Organic Pollutants in Groundwater,
W83-00158 5A

ORGANIC MATTER
Removing Soluble Organic Contaminants by Lime-Softening,
W83-00172 5F

Structural Characterization of Aquatic Humic Material,
W83-00190 5C

Secondary Treatment.
W83-00325 5D

ORGANIC WASTES
Stabilizing High-Strength Wastes with Photosynthetic Bacteria,
W83-00181 5D

ORGANOPHOSPHATES
Determination of Organophosphorus and Organosulphur at the Sub-NG-Level for Use in Water Analysis,
W83-00046 5A

ORGANOSULFATES
Determination of Organophosphorus and Organosulphur at the Sub-NG-Level for Use in Water Analysis,
W83-00046 5A

ORINOCO RIVER
The Chemistry and Phytoplankton of the Orinoco and Caroni Rivers, Venezuela,
W83-00187 5B

OSMOTIC PRESSURE
Seasonal Progressions in the Water Relations of Deciduous and Evergreen Perennials in the Northern California Chaparral,
W83-00307 2I

OVERLAND FLOW
Modeling Erosion in Overland Flow,
W83-00104 4D

OXIDATION
Biooxidation of Paint Process Wastewater,
W83-00143 5D

Secondary Treatment.
W83-00325 5D

OXIDATION PROCESS
Anoxic Nutrient Regeneration and the Eutrophication of Estuarine Waters,
W83-00263 5C

OXYGEN TRANSFER
Storage of Carbon and Transport of Oxygen in River Macrophytes: Mass-Balance, and the Measurement of Primary Productivity in Rivers,
W83-00051 5B

OXYGENATION
The Use of Oxygen to Uprate the Treatment Capacity of a Conventional Surface-Aeration Plant at Holdenhurst (Bournemouth) Sewage Treatment Works,
W83-00133 5D

OYSTERS
Heavy Metals in Oysters and Clams of St. Louis Bay, Mississippi,
W83-00159 5C

Polynuclear Aromatic Hydrocarbons and Cellular Proliferative Disorders in Bivalue Molluscs from Oregon Estuaries,
W83-00295 5C

OZONATION
Disinfection, Odor Prevention and Control.
W83-00154 5D

PACIFIC ISLANDS
Remote Sensing of Water Resources on Pacific Islands,
W83-00262 7C

PAINT INDUSTRY
Biooxidation of Paint Process Wastewater,
W83-00143 5D

PALAU
Remote Sensing of Water Resources on Pacific Islands,
W83-00262 7C

PALEOLIMNOLOGY
Paleoecological Studies of the Recent Development of the Lake Vaxjosjon. IV. Interpretation of the Eutrophication Process Through the Analysis of Subfossil Chironomids,
W83-00028 5C

The Recent Histories of Three Canadian Shield Lakes: A Paleolimnological Experiment,
W83-00042 5C

Paleolimnology of Lake Isle, Alberta, Canada (Including Sediment Chemistry, Pigments and Diatom Stratigraphy),
W83-00316 2H

PAPAGO INDIAN RESERVATION
Application of Remote Sensing in Evaluating Floodwater Farming on the Papago Indian Reservation,
W83-00230 3F

PARAMETRIC HYDROLOGY
IIHR Distrubuted Parameter Watershed Model,
W83-00269 2E

PARASITISM
The Occurrence of a Fungal Parasite on a Tetraselmis (Prasinophyceae) Species,
W83-00288 5C

PARTICLE SIZE
The Characterization and Processing of Lime Sludges from Water Reclamation Plants,
W83-00086 5D

PARTICULATE MATTER
The Development of Attenuance Depth-Profiling to Follow the Changing Distribution of Phytoplankton and Other Particulate Material in a Productive English Lake,
W83-00055 5C

Improvements in Quantifying the Phosphorus Concentration in Lake Water,
W83-00208 5C

Coliform Attachment to Suspended Particles in Stormwater,
W83-00224 5B

Cause of Inefficient Solids Separation in the Activated Sludge Process,
W83-00232 5D

Nitrogen Metabolism in Lake Kizaki, Japan II. Distribution and Decomposition of Organic Nitrogen,
W83-00345 2H

PATH OF POLLUTANTS
Effects of Effluent Spray Irrigation on Ground Water at a Test Site Near Tarpon Springs, Florida,
W83-00068 5B

Transport of Organic Carbon to the Oceans by Rivers of North America: A Synthesis of Existing Data,
W83-00174 5B

PATHOGENIC FUNGI
The Occurrence of a Fungal Parasite on a Tetraselmis (Prasinophyceae) Species,
W83-00288 5C

PEAK DEMAND
Rural Water Supply Systems: Improved Planning Strategies Through Systems Analysis,
W83-00241 6A

PENNSYLVANIA
Sludge Disposal from Acid Mine Drainage Treatment,
W83-00298 5E

PERIDINIUM
The Relationship Between Nutrient Status and Chemical Composition of Peridinium Cinctum During the Bloom in Lake Kinneret,
W83-00333 5C

PERMITS
The Clean Water Act's Section 404 Permit Program Enters its Adolescence: An Institutional and Programmatic Perspective,
W83-00210 5G

PERSISTENCE
Persistence in Model Ecosystems,
W83-00294 5B

PERSONNEL
Manpower Needs in Wastewater Treatment and Collection Systems for the Years 1980 to 2000,
W83-00180 5G

PERU
Investigations on the Lakes of Peru and Their Phytoplankton. 6 Additional Chemical Analyses,
W83-00037 2H

PETTAQUAMSCUTT RIVER ESTUARY
Anoxic Nutrient Regeneration and the Eutrophication of Estuarine Waters,
W83-00263 5C

PHENOLS
The Fate of 2,4,6-Trichlorophenol in an Aquatic Continuous-Flow System,
W83-00332 5B

PHOSPHATASE
Phytoplankton Contribution to Alkaline Phosphatase Activity,
W83-00041 2H

PHOSPHATASES
Induction of High Phosphatase Activity by Aluminum in Acid Lakes,
W83-00029 5B

Characterization of Acid Phosphatases in the Acidified Lake Gardsjon, Sweden,
W83-00050 5C

PHOSPHATES
Phosphate and Wind in a Shallow Lake,
W83-00184 5B

PHOSPHORUS
Mass Balance Model Estimation of Phosphorus Concentrations in Reservoirs,
W83-00009 5C

Applicability of Phosphorus Budget Models to Southern African Man-Made Lakes,
W83-00025 5C

Determination of Organophosphorus and Organosulphur at the Sub-NG-Level for Use in Water Analysis,
W83-00046 5A

A Study of Trends in Total Phosphorus Measurements at Nasqan Stations,
W83-00126 5B

Effects of Michigan's Phosphorus Detergent Ban on Municipal Chemical Costs,
W83-00147 5G

Improvements in Quantifying the Phosphorus Concentration in Lake Water,
W83-00208 5C

The Effects of Excessive Nitrogen and Phosphorus in Surface Waters of a Prairie Marsh,
W83-00266 5G

PHOSPHORUS REMOVAL
Control of Lake Phosphorus with Aluminum Sulfate: Dose Determination and Application Techniques,
W83-00006 5C

Nutrient Removal From Wastewater by Wetlands,
W83-00226 5D

Bacterioplankton Affected by Phosphorus Precipitation Treatment in a Polytrophic Lake,
W83-00315 5G

PHOTOSYNTHETIC BACTERIA
Stabilizing High-Strength Wastes with Photosynthetic Bacteria,
W83-00181 5D

PHYSICOCHEMICAL PROPERTIES
Physicochemical Limnology of the Tongue River Reservoir, Montana,
W83-00033 2H

PHYTOPLANKTON
A Principal Components Analysis of the Phytoplankton from a Pond in the Parana River Valley, Argentina,
W83-00022 5C

Existence of Phytoplankton in Spirit Lake Near Active Volcano Mt. St. Helens, Washington, U.S.A.: Post-Eruption Findings,
W83-00026 5C

Limnological Investigations of a Mountain Spring Pond in the Swiss National Park,
W83-00034 2H

Investigations on the Lakes of Peru and Their Phytoplankton. 6 Additional Chemical Analyses,
W83-00037 2H

Diel Periodicity in the Chemical Composition of Lake Phytoplankton,
W83-00049 5B

Seasonal Abundance of Ceratium Hirundinella, (O.F. Muller) Schrank in Lakes of Different Trophy,
W83-00052 5C

An Integrated Study on Littoral and Pelagic Primary Production in a Southern African Coastal Lake,
W83-00053 5C

The Development of Attenuance Depth-Profiling to Follow the Changing Distribution of Phytoplankton and Other Particulate Material in a Productive English Lake,
W83-00055 5C

In Situ Response of Phytoplankton Fluorescence to Rapid Variations in Light,
W83-00141 5C

Dynamics of Phytoplankton in Finnish Lakes,
W83-00153 5C

The Chemistry and Phytoplankton of the Orinoco and Caroni Rivers, Venezuela,
W83-00187 5B

Nitrogen Metabolism in Lake Kizaki, Japan I. Ammonium and Nitrate Uptake by Phytoplankton,
W83-00344 2H

PINE TREES
Pine Tree Evapotranspiration,
W83-00279 2D

PIPELINES
Mains and Services.
W83-00313 8C

PIPES
Mains and Services.
W83-00313 8C

PLANKTON
Bacterioplankton Affected by Phosphorus Precipitation Treatment in a Polytrophic Lake,
W83-00315 5G

PLANNING
The Probability Distribution of Water Inputs and the Economic Benefits of Supplementary Irrigation,
W83-00016 6A

Municipal Pretreatment Program Development,
W83-00350 5D

PLANT GROWTH
Dendrography for Optimal Water and Energy Utilization in Plant Growth,
W83-00265 3F

PLANT MORPHOLOGY
Variability in Crop Physiological and Morphological Characteristics Controlling Water Use Efficiency and Grain Yield,
W83-00234 3F

PLANT PHYSIOLOGY
Variability in Crop Physiological and Morphological Characteristics Controlling Water Use Efficiency and Grain Yield,
W83-00234 3F

PLANT WATER POTENTIALS
Seasonal Progressions in the Water Relations of Deciduous and Evergreen Perennials in the Northern California Chaparral,
W83-00307 2I

PLASTICS
Plastics Give 20 Years Life-Span - with Virtually Zero Maintenance.
W83-00008 8G

PLUMBLINES
Plumbline Monitor Interface,
W83-00094 8G

PLUTONIUM
Characterization of Plutonium in Ground Water Near the Idaho Chemical Processing Plant,
W83-00019 5B

POISONS
The Toxicology of Silver Iodide in Relation to its use as a Cloud Seeding Agent,
W83-00084 2B

POLAROGRAPHIC ANALYSIS
Differential Pulse Polarography of Some Herbicides Derived From 2,4-Dichlorophenoxyacetic Acid, II. Determination of Herbicide Residues in Irrigation Waters,
W83-00045 5A

POLAROGRAPHY
Differential Pulse Polarography of Some Herbicides Derived From 2,4-Dichlorophenoxyacetic Acid, II. Determination of Herbicide Residues in Irrigation Waters,
W83-00045 5A

POLICY MAKING
Policy Objectives and Information System for Irrigation Projects-India,
W83-00011 6A

POLLUTANT IDENTIFICATION
Determination of Pyrazon Residues in Water by Reversed Phase High Performance Liquid Chromatography,
W83-00014 5A

Differential Pulse Polarography of Some Herbicides Derived From 2,4-Dichlorophenoxyacetic Acid, II. Determination of Herbicide Residues in Irrigation Waters,
W83-00045 5A

Determination of Organophosphorus and Organosulphur at the Sub-NG-Level for Use in Water Analysis,
W83-00046 5A

Determination of Boron in River Water with Flameless Atomic Absorption Spectrometry (Graphite Furnace Technique),
W83-00047 5A

Chemical Surveillance of Rivers,
W83-00134 5A

Bioassay Technique for Relative Toxicity in Water Pollution Control,
W83-00146 5A

Characterization of Organic Contaminants in Environmental Samples Associated with Mount St. Helens 1980 Volcanic Eruption,
W83-00161 5A

Determination of Benzidines by Gas Chromatographic Separation of Derivatives with Electron Capture Detection,
W83-00182 5A

Determination of Iron in Natural Waters and Plant Material with 1,10-Phenanthroline by Flow Injection Analysis,
W83-00194 5A

Pre-Concentration Technique for Cold-Vapour Atomic-Fluorescence Determination of Mercury in Drinking Waters,
W83-00195 5A

Determination of Organic Contaminants in Ultra-Pure Water by Reversed-Phase High-Performance Liquid Chromatography with Ultraviolet Detection,
W83-00202 5A

Comparison of Sulfide-Selective Electrode and Gas-Stripping Monitors for Hydrogen Sulfide in Effluents,
W83-00204 5A

Components Contributing to Light Extinction in Natural Water: Method of Isolation,
W83-00213 5A

Hazardous Pollutant Analysis in Water Using Infrared Spectroscopy,
W83-00231 5A

The Chemical Composition of Water and the Analytical Chemist: A Challenge,
W83-00290 5A

Determination of Benzidines in Industrial and Municipal Wastewaters,
W83-00292 5A

Design of Monitoring Studies for Priority Pollutants,
W83-00321 7A

Preconcentration of Environmental Tin and its Determination Using Catechol Violet,
W83-00348 5A

POLLUTION
Land Application of Municipal Sludge with Regard to Cropping Systems and Pollution Potential,
W83-00233 5E

POLLUTION LOAD
Non-Point Pollution Control for Rangeland Wintering, Livestock Operations (Ground Cover),
W83-00252 5G

POLYAROMATIC HYDROCARBONS
Adsorption of PAH to Aquatic Humus,
W83-00038 5B

POLYBROMINATED BIPHENYLS
Association Studies of Polybrominated Biphenyls in Aquatic Systems,
W83-00160 5B

POLYCYCLIC AROMATIC HYDROCARBONS
Polycyclic Aromatic Hydrocarbons in Sewage, Mussels and Tap Water,
W83-00330 5B

POLYNUCLEAR AROMATIC HYDROCARBONS
Polynuclear Aromatic Hydrocarbons and Cellular Proliferative Disorders in Bivalue Molluscs from Oregon Estuaries,
W83-00295 5C

PONAPE ISLAND
Assessment of Low Head, Micro Hydroelectric Equipment for Use on Small Tropical Islands,
W83-00268 8C

PONDS
A Principal Components Analysis of the Phytoplankton from a Pond in the Parana River Valley, Argentina,
W83-00022 5C

Dissolved Organic Carbon and UV-Absorption in a Polluted Lowland Brook-Pond System,
W83-00024 5G

POPLAR TREES
Dendrography for Optimal Water and Energy Utilization in Plant Growth,
W83-00265 3F

POPULATION DYNAMICS
Impact of Chromium to the Population Dynamics of Tisbe Holothuriae,
W83-00043 5C

Dynamics of Phytoplankton in Finnish Lakes,
W83-00153 5C

POROUS MEDIA
Development of Novel Porous Substrates for Ultrafiltration, Desalination and Water Reclamation--Part III,
W83-00259 3A

POTENTIOMETRIC LEVEL
Applications of Digital Modeling for Evaluating the Ground-Water Resources of the '2,000-Foot' Sand of the Baton Rouge Area, Louisiana,
W83-00109 4B

Map Showing the Potentiometric Surface of the Magothy Aquifer in Southern Maryland, September 1981,
W83-00115 7C

POTOMAC RIVER
Reservoir Management in Potomac River Basin,
W83-00203 6A

POULTRY
Water and Waste Management in the Canadian Meat and Poultry Processing Industry.
W83-00082 3E

PRECIPITATION
Hydrologic Data for Experimental Agricultural Watersheds in the United States, 1973,
W83-00095 7C

Factors Controlling Stable Isotope Composition of European Precipitation,
W83-00176 2B

Stochastic Daily Precipitation Modeling and Daily Streamflow Transfer Processes,
W83-00282 2E

Influence of Prescribed Burning on Nutrient Budgets of Mountain Fynbos Catchments in the S. W. Cape, Rep. of South Africa,
W83-00304 5B

Erosion and Sedimentation as Part of the Natural System,
W83-00305 2J

PREDICTION
Instream Salmonid Habitat Exclusion by Ice-Cover,
W83-00257 8I

PRESCRIBED BURNING
Influence of Prescribed Burning on Nutrient Budgets of Mountain Fynbos Catchments in the S. W. Cape, Rep. of South Africa,
W83-00304 5B

PRIMARY PRODUCTION
An Integrated Study on Littoral and Pelagic Primary Production in a Southern African Coastal Lake,
W83-00053 5C

PRIMARY PRODUCTIVITY
Storage of Carbon and Transport of Oxygen in River Macrophytes: Mass-Balance, and the Measurement of Primary Productivity in Rivers,
W83-00051 5B

PRIMARY WASTEWATER TREATMENT
Primary Treatment.
W83-00337 5D

PROCESS CONTROL
Adenosine Triphosphate as a Control Parameter for Activated Sludge Processes,
W83-00149 5D

Control Operations and Maintenance Services.
W83-00157 5D

Metering, Monitoring and Quality Control.
W83-00336 8G

PRODUCTIVITY
Limnological Investigations of a Mountain Spring Pond in the Swiss National Park,
W83-00034 2H

Storage of Carbon and Transport of Oxygen in River Macrophytes: Mass-Balance, and the Measurement of Primary Productivity in Rivers,
W83-00051 5B

An Integrated Study on Littoral and Pelagic Primary Production in a Southern African Coastal Lake,
W83-00053 5C

PUBLIC PARTICIPATION
A Cooperative Water Resource Technology Transfer Program,
W83-00216 6B

PUBLIC RELATIONS
Spreading Lagooned Sewage Sludge on Farmland: A Case History,
W83-00296 5E

PUERTO RICO
Geohydrologic Descriptions of Selected Solid-Waste Disposal Sites,
W83-00072 5B

PULP AND PAPER INDUSTRY
Pulp and Paper Effluent Management,
W83-00164 5D

PUMPS
Large Water Transport Pumps,
W83-00206 8C

PYRAZON
Determination of Pyrazon Residues in Water by Reversed Phase High Performance Liquid Chromatography,
W83-00014 5A

QUALITY CONTROL
Accuracy of Determination of Ammoniacal Nitrogen in River Waters: Analytical Quality Control in the Harmonised Monitoring Scheme.
W83-00196 5A

RADIOACTIVE WASTE DISPOSAL
Characterization of Plutonium in Ground Water Near the Idaho Chemical Processing Plant,
W83-00019 5B

RADIOACTIVE WASTES
Observations on the Bioaccumulation Potential of Thorium and Uranium in Rainbow Trout (Salmo Gairdneri),
W83-00021 5C

RAIN
Role of Fungi in Postfire Stabilization of Chaparral Ash Beds,
W83-00302 4D

RAINFALL
The USLE Rainfall Factor for Southwestern U. S. Rangelands,
W83-00098 4D

RAINFALL INENSITY
The Spatial Distribution in Southern Africa of Rainfall Erosivity for Use in the Universal Soil Loss Equation,
W83-00140 2J

RAINFALL INTENSITY
The USLE Rainfall Factor for Southwestern U. S. Rangelands,
W83-00098 4D

A Test of the USLE on Bare and Sagebrush Plots in Utah,
W83-00101 4D

RAINFALL RATE
Effects of Slope Length and Steepness on Soil Erosion from Rangelands,
W83-00099 2J

RAINFALL-RUNOFF RELATIONSHIPS
Estimating Runoff Volumes from Urban Areas,
W83-00007 4A

Hydrologic Data for Urban Storm Runoff from Nine Sites in the Denver Metropolitan Area, Colorado,
W83-00077 7C

Stormwater Runoff Treatment by Impoundment: Barrhaven Pilot Study,
W83-00083 5D

Modeling Erosion in Overland Flow,
W83-00104 4D

Application of Remote Sensing in Evaluating Floodwater Farming on the Papago Indian Reservation,
W83-00230 3F

RAINFALL SIMULATORS
Use of Rainfall Simulators to Determine Parameters for Erosion Prediction,
W83-00102 2J

RANGE MANAGEMENT
Special Problems in the Application of the USLE to Rangelands: C and P Factors,
W83-00100 2J

RANGELAND
Relation of USLE Factors to Erosion on Rangeland,
W83-00096 2J

Use of Erosion Models on Western Rangelands,
W83-00097 2J

The USLE Rainfall Factor for Southwestern U. S. Rangelands,
W83-00098 4D

Effects of Slope Length and Steepness on Soil Erosion from Rangelands,
W83-00099 2J

Predicting Sediment Yields from Sagebrush Rangelands,
W83-00106 4D

RANGELANDS
Special Problems in the Application of the USLE to Rangelands: C and P Factors,
W83-00100 2J

A Test of the USLE on Bare and Sagebrush Plots in Utah,
W83-00101 4D

Estimating Sediment Yield from Rangeland with CREAMS,
W83-00103 2J

RECLAIMED WATER
Correlation of Rotifer Associations in a Chain of Lakes Fed by Reclaimed Sewage,
W83-00023 5G

The Characterization and Processing of Lime Sludges from Water Reclamation Plants,
W83-00086 5D

Water Reclamation and Reuse,
W83-00163 5D

Development of Novel Porous Substrates for Ultrafiltration, Desalination and Water Reclamation--Part III,
W83-00259 3A

RECREATION
Potential Flood and Debris Hazards at Cottonwood Cove, Lake Mead National Recreation Area, Clark County, Nevada,
W83-00070 2E

RECYCLING
Recycling of Mercury and Silver from COD Tests,
W83-00145 5D

REESE RIVER
Ho: For Reese River Natural Resources of the Toiyabe-Toquima Highlands, Central Nevada,
W83-00253 6B

REGIONAL ANALYSIS
Summary Appraisals of the Nation's Ground-Water Resources--New England Region,
W83-00120 4B

REGIONAL PLANNING
Case Study Analyses of 208 Program Effectiveness in Improving Regional Water Resources Management,
W83-00240 6B

REGULATIONS
Water Quality Standards and Water Quality,
W83-00162 5G

Law,
W83-00165 6E

REMOTE SENSING
Application of Remote Sensing in Evaluating Floodwater Farming on the Papago Indian Reservation,
W83-00230 3F

Remote Sensing of Water Resources on Pacific Islands,
W83-00262 7C

RESEARCH PRIORITIES
Conservation Through Crops Research,
W83-00311 3F

RESERVOIR CONSTRUCTION
Kielder - Planning to Meet the Future.
W83-00207 8A

RESERVOIR DESIGN
Kielder - Planning to Meet the Future.
W83-00207 8A

RESERVOIR OPERATION
Reservoir Management in Potomac River Basin,
W83-00203 6A

Application to the Des Moines River of Multiple Reservoir Operating Strategies Incorporating Short-and Long-Term Information in Real Time,
W83-00248 4A

Water Quality Simulation of Wahiawa Reservoir, O'Ahu, Hawaii,
W83-00281 5G

RESERVOIR STORAGE
Blackheath Water Treatment Plant,
W83-00283 5F

RESERVOIRS
Mass Balance Model Estimation of Phosphorus Concentrations in Reservoirs,
W83-00009 5C

Distribution of Chironomids in the Littoral Zone of Lake Texoma, Oklahoma and Texas,
W83-00031 2H

Physicochemical Limnology of the Tongue River Reservoir, Montana,
W83-00033 2H

Application to the Des Moines River of Multiple Reservoir Operating Strategies Incorporating Short-and Long-Term Information in Real Time,
W83-00248 4A

Some Variations in Distribution of Fishes in Large Mainstream Reservoirs Associated with Artificial Cover,
W83-00255 8I

Water Storage.
W83-00340 8C

RESINS
Preparation of Thin-Ion-Exchange Membranes with Exceptionally Low Resistances and High Selectivities.
W83-00261 3A

RESOURCES DEVELOPMENT
Ho: For Reese River Natural Resources of the Toiyabe-Toquima Highlands, Central Nevada,
W83-00253 6B

RESOURCES MANAGEMENT
High Plains-Ogallala Aquifer Study, New Mexico -- Economic Impacts,
W83-00308 6B

REVERSE OSMOSIS
Hydrodynamics and Fouling of Pressure Driven Membrane Desalination and Water Treatment Systems,
W83-00244 3A

Development of Chlorine Resistant Membranes, Polyimide Membranes and Porous Substrates,
W83-00246 3A

Development and Demonstration of a Reverse-Osmosis Energy-Recovery Device,
W83-00256 3A

A Study of Glow Discharge Polymerization as a Means of Preparing Composite Reverse Osmosis Membranes with Ultrathin Skin,
W83-00260 3A

Development of Composite Hollow Fibers - Phase III,
W83-00267 3A

Diatomite Precoat Filtration for Pretreatment of Seawater Prior to Reverse Osmosis,
W83-00270 3A

Water Treatment for Small Public Supplies,
W83-00280 5F

REVIEWS
Water Reclamation and Reuse,
W83-00163 5D

Pulp and Paper Effluent Management,
W83-00164 5D

Law,
W83-00165 6E

Water Characteristics,
W83-00169 5B

An Overview of Acid Rain Monitoring Activities in North America,
W83-00189 5C

REVIEWS

Ho: For Reese River Natural Resources of the Toiyabe-Toquima Highlands, Central Nevada,
W83-00253 6B

RHODE ISLAND
Anoxic Nutrient Regeneration and the Eutrophication of Estuarine Waters,
W83-00263 5C

RIVER BASINS
Quality of Surface Water at Selected Sites in the Suwannee River Basin, Florida, 1980,
W83-00113 7C

RIVERS
Large-Scale Bedforms in the Platte River Downstream from Grand Island, Nebraska: Structure Process, and Relationship to Channel Narrowing,
W83-00111 4D

Chemical Surveillance of Rivers,
W83-00134 5A

Transport of Organic Carbon to the Oceans by Rivers of North America: A Synthesis of Existing Data,
W83-00174 5B

ROAD CONSTRUCTION
The Recent Histories of Three Canadian Shield Lakes: A Paleolimnological Experiment,
W83-00042 5C

ROTIFERS
Correlation of Rotifer Associations in a Chain of Lakes Fed by Reclaimed Sewage,
W83-00023 5G

RUNOFF
Hydrologic Data for Experimental Agricultural Watersheds in the United States, 1973,
W83-00095 7C

Relation of USLE Factors to Erosion on Rangeland,
W83-00096 2J

Effects of Slope Length and Steepness on Soil Erosion from Rangelands,
W83-00099 2J

RUNOFF RATES
Testing the Modified Universal Soil Loss Equation,
W83-00107 4D

RUNOFF VOLUME
Estimating Runoff Volumes from Urban Areas,
W83-00007 4A

Testing the Modified Universal Soil Loss Equation,
W83-00107 4D

RURAL AREAS
Rural Water Supply Systems: Improved Planning Strategies Through Systems Analysis,
W83-00241 6A

Wastewater Management Problems in Rural Communities,
W83-00249 5G

SAGEBRUSH
Predicting Sediment Yields from Sagebrush Rangelands,
W83-00106 4D

SALINE-FRESHWATER INTERFACES
Estimated Effects of Projected Ground-Water With-Drawals on Movement of the Saltwater Front in the Floridan Aquifer, 1976-2000, West-Central Florida,
W83-00130 4B

SALINE WATER
Development of New Chemical Additives and Treatments for Scale Control in Saline Water Evaporators,
W83-00222 3A

SALINE WATER INTRUSION
Reevaluation of the Effects of Deicing Salt Runoff on a Small Urban Lake,
W83-00227 5C

SALINITY
Distribution of Chironomids in the Littoral Zone of Lake Texoma, Oklahoma and Texas,
W83-00031 2H

SALT
Seasonal Changes of Dissolved Sodium in the Connecticut River Near Northfield, Massachusetts,
W83-00139 5B

SALT BALANCE
Use of the Water-Salt Balance Method for Calculating the Desalination Regime of a Large Water Body,
W83-00322 5G

SALT REJECTION
Development of Composite Hollow Fibers - Phase III,
W83-00267 3A

SAMPLE PREPARATION
Pre-Concentration Technique for Cold-Vapour Atomic-Fluorescence Determination of Mercury in Drinking Waters,
W83-00195 5A

SAMPLING
Chemical Surveillance of Rivers,
W83-00134 5A

Improvements in Quantifying the Phosphorus Concentration in Lake Water,
W83-00208 5C

SCALING
Chemical Stability of Water.
W83-00091 5F

Development of New Chemical Additives and Treatments for Scale Control in Saline Water Evaporators,
W83-00222 3A

SCOTLAND
Accuracy of Determination of Ammoniacal Nitrogen in River Waters: Analytical Quality Control in the Harmonised Monitoring Scheme.
W83-00196 5A

SCREENS
Water Supply and Treatment, Section C-1, Raw Water Preparation.
W83-00335 5F

Primary Treatment.
W83-00337 5D

SEASONAL VARIATION
Seasonal Variation of Zooplankton of the Veli Lake, South-West Coast of India,
W83-00027 2H

Species Composition and Distribution of Zooplankton in a Tropical Lake, Lake Naivasha, Kenya,
W83-00056 5B

Pine Tree Evapotranspiration,
W83-00279 2D

SEAWATER
Diatomite Precoat Filtration for Pretreatment of Seawater Prior to Reverse Osmosis,
W83-00270 3A

SECONDARY WASTEWATER TREATMENT
High-Quality Trickling Filter Effluent Without Tertiary Treatment,
W83-00142 5D

Secondary Treatment.
W83-00325 5D

SEDIMENT LOAD
Influence of Prescribed Burning on Nutrient Budgets of Mountain Fynbos Catchments in the S. W. Cape, Rep. of South Africa,
W83-00304 5B

SEDIMENT-WATER INTERACTIONS
Heavy Metal Interactions and Dynamics in Simulated Naugatuck River Microcosms,
W83-00214 5B

SEDIMENT YIELD
Estimating Sediment Yield from Rangeland with CREAMS,
W83-00103 2J

Predicting Sediment Yields from Sagebrush Rangelands,
W83-00106 4D

SEDIMENTARY STRUCTURES
Large-Scale Bedforms in the Platte River Downstream from Grand Island, Nebraska: Structure Process, and Relationship to Channel Narrowing,
W83-00111 4D

SEDIMENTATION
Runoff and Sedimentation Potentials Influenced by Litter and Slope on a Chaparral Community in Central Arizona,
W83-00301 4D

Estimating Hydrologic Values for Planning Wildland Fire Protection,
W83-00306 6B

Water Supply and Treatment, Section C-1, Raw Water Preparation.
W83-00335 5F

Primary Treatment.
W83-00337 5D

SEDIMENTATION RATES
Erosion and Sedimentation as Part of the Natural System,
W83-00305 2J

SEDIMENTS
Some Notes on the Ecology of Aquatic Oligochaetes in the Delta Region of the Netherlands,
W83-00035 2L

Perennial-Streamflow Characteristics Related to Channel Geometry and Sediment in Missouri River Basin,
W83-00121 4D

Heavy Metals in Oysters and Clams of St. Louis Bay, Mississippi,
W83-00159 5C

Association Studies of Polybrominated Biphenyls in Aquatic Systems,
W83-00160 5B

SELF-PURIFICATION
Some Aspects of the Colonization by Water Mites (Acari, Actinedida) of an Artifical Substrate in a Disturbed Environment,
W83-00054 5C

SEPTIC TANKS
Daily Chemical Variability of Domestic Septic Tank Effluent,
W83-00328 5D

SEWER SYSTEMS
Sewer Maintenance and Rehabilitation.
W83-00156 5D

Intensive Flow Monitoring--Cost-Effectiveness with a Quality Edge,
W83-00200 5G

Collection Systems.
W83-00338 8C

SEX REVERSAL (FISH)
Production of Reproductively Limited Grass Carp for Biological Control of Aquatic Weeds - Phase II,
W83-00272 4A

SHIELD LAKES
The Recent Histories of Three Canadian Shield Lakes: A Paleolimnological Experiment,
W83-00042 5C

SHRIMP
Evaluation of Limnological Parameters as Related to the Success of Mysis Relicta Introductions,
W83-00254 8I

SIDESTREAMS
Evaluation and Control of Sidestreams Generated in Publicly Owned Treatment Works,
W83-00291 5D

SILVER
Recycling of Mercury and Silver from COD Tests,
W83-00145 5D

SILVER IODIDE
The Toxicology of Silver Iodide in Relation to its use as a Cloud Seeding Agent,
W83-00084 2B

SIMULATION ANALYSIS
Water Quality Simulation of Wahiawa Reservoir, O'Ahu, Hawaii,
W83-00281 5G

SITE SELECTION
Use of Fracture Traces in Water Well Location: a Handbook.
W83-00217 4B

Geologic Criteria in Waste-Management Site Selection in Northeastern North Dakota,
W83-00236 5E

SLOPES
Effects of Slope Length and Steepness on Soil Erosion from Rangelands,
W83-00099 2J

Runoff and Sedimentation Potentials Influenced by Litter and Slope on a Chaparral Community in Central Arizona,
W83-00301 4D

SLUDGE
The Characterization and Processing of Lime Sludges from Water Reclamation Plants,
W83-00086 5D

High pH Stabilization of Wastewater Sludge Using Chemical Softening Wastes From Water Treatment,
W83-00243 5D

SLUDGE DIGESTION
A Simulation Study on the Operation of Laboratory Scale Anaerobic Digesters,
W83-00138 5D

Sludge Digestion and Disposal.
W83-00152 5D

Digester Control Pays Dividends,
W83-00192 5D

SLUDGE DISPOSAL
Sludge Digestion and Disposal.
W83-00152 5D

Land Application of Municipal Sludge with Regard to Cropping Systems and Pollution Potential,
W83-00233 5E

High pH Stabilization of Wastewater Sludge Using Chemical Softening Wastes From Water Treatment,
W83-00243 5D

Spreading Lagooned Sewage Sludge on Farmland: A Case History,
W83-00296 5E

Sludge Disposal from Acid Mine Drainage Treatment,
W83-00298 5E

SLUDGE DRYING
The Characterization and Processing of Lime Sludges from Water Reclamation Plants,
W83-00086 5D

SLUDGE THICKENING
Effect of Activated Sludge Operational Conditions on Sludge Thickening Characteristics,
W83-00179 5D

SMALL WATERSHEDS
Annual Peak Discharges from Small Drainage Areas in Montana Through September 1981,
W83-00071 2E

Water-Quality Characteristics of Six Small, Semiarid Watersheds in the Green River Coal Region of Colorado,
W83-00124 5A

Investigation of Trends in Flooding in the Tug Fork Basin of Kentucky, Virginia, and West Virginia,
W83-00128 4A

SMOKY MOUNTAINS
Water Quality of Streams in the Great Smoky Mountains National Park,
W83-00032 5B

SNOWMELT
Reevaluation of the Effects of Deicing Salt Runoff on a Small Urban Lake,
W83-00227 5C

SOCIAL IMPACT
Environmental Impact of Large Hydroelectric Projects on Tropical Countries,
W83-00010 6G

Irrigation Planning in the Tana Basin of Kenya,
W83-00015 6B

SODIUM
New EPA Sodium and Corrosion Regulations: Their Basis and Impacts,
W83-00137 5G

Seasonal Changes of Dissolved Sodium in the Connecticut River Near Northfield, Massachusetts,
W83-00139 5B

SOIL CHARACTERISTICS
Geologic Criteria in Waste-Management Site Selection in Northeastern North Dakota,
W83-00236 5E

SOIL CLASSIFICATION
Soil Survey of the Experimental Catchments Near Bethlehem,
W83-00087 4D

Soil Characterization and Alternate Shoreline Erosion Control Measures for Constructed Lakes in Iowa,
W83-00218 4D

SOIL DISPOSAL FIELDS
The Effects of the Disposal of Sewage Effluents on Groundwater Quality in the United Kingdom,
W83-00220 5E

SOIL EROSION
Hydrology and Water Resources of the Drakensberg,
W83-00085 4A

Relation of USLE Factors to Erosion on Rangeland,
W83-00096 2J

Use of Erosion Models on Western Rangelands,
W83-00097 2J

The USLE Rainfall Factor for Southwestern U. S. Rangelands,
W83-00098 4D

Effects of Slope Length and Steepness on Soil Erosion from Rangelands,
W83-00099 2J

Special Problems in the Application of the USLE to Rangelands: C and P Factors,
W83-00100 2J

A Test of the USLE on Bare and Sagebrush Plots in Utah,
W83-00101 4D

Use of Rainfall Simulators to Determine Parameters for Erosion Prediction,
W83-00102 2J

Estimating Sediment Yield from Rangeland with CREAMS,
W83-00103 2J

Modeling Erosion in Overland Flow,
W83-00104 4D

Testing the Modified Universal Soil Loss Equation,
W83-00107 4D

The Spatial Distribution in Southern Africa of Rainfall Erosivity for Use in the Universal Soil Loss Equation,
W83-00140 2J

Role of Fungi in Postfire Stabilization of Chaparral Ash Beds,
W83-00302 4D

Erosion and Sedimentation as Part of the Natural System,
W83-00305 2J

SOIL EROSIONS
Developing a USLE Cover-Management (C) Factor Procedure for Forest Conditions,
W83-00108 4D

SOIL FUNGI
Role of Fungi in Postfire Stabilization of Chaparral Ash Beds,
W83-00302 4D

SOIL MOISTURE DEFICIENCY
Efficient Use of Water for Irrigation in the Upper Midwest,
W83-00242 3F

Irrigation Scheduling,
W83-00310 3F

SOIL PROPERTIES
Adjustment of Soil Limitations,
W83-00286 2G

SOIL STABILIZATION
Adjustment of Soil Limitations,
W83-00286 2G

SOIL SURVEYS
Soil Survey of the Experimental Catchments Near Bethlehem,
W83-00087 4D

Soil Maps of Montana,
W83-00237 7C

SOIL TREATMENT
Adjustment of Soil Limitations,
W83-00286 2G

SOIL WATER
Nitrate Movement and Denitrification Defined Relative to Bromide Tracer in Tile-Drained Land,
W83-00264 5B

SOIL-WATER-PLANT RELATIONSHIPS
Adjustment of Soil Limitations,
W83-00286 2G

SOLID WASTE DISPOSAL
Geohydrologic Descriptions of Selected Solid-Waste Disposal Sites,
W83-00072 5B

SOLID WASTES
Solid Waste Management in South Africa,
W83-00090 5G

SOLIDS CONTACT PROCESSES
High-Quality Trickling Filter Effluent Without Tertiary Treatment,
W83-00142 5D

SOLUTES
Removing Soluble Organic Contaminants by Lime-Softening,
W83-00172 5F

SOLVENTS
Biooxidation of Paint Process Wastewater,
W83-00143 5D

SOUTH AFRICA
Applicability of Phosphorus Budget Models to Southern African Man-Made Lakes,
W83-00025 5C

The Structure and Some Recent Changes of the Zoobenthic Community in the Ermatinger Becken, A Shallow Littoral Part of Lake Constance,
W83-00036 2H

An Integrated Study on Littoral and Pelagic Primary Production in a Southern African Coastal Lake,
W83-00053 5C

Hydrology and Water Resources of the Drakensberg,
W83-00085 4A

Soil Survey of the Experimental Catchments Near Bethlehem,
W83-00087 4D

The Statistics of Extreme Values and the Analyses of Floods in South Africa,
W83-00089 2E

Solid Waste Management in South Africa,
W83-00090 5G

The Spatial Distribution in Southern Africa of Rainfall Erosivity for Use in the Universal Soil Loss Equation,
W83-00140 2J

Blackheath Water Treatment Plant,
W83-00283 5F

Adjustment of Soil Limitations,
W83-00286 2G

A Weighing Lysimeter Facility at Roodeplaat for Crop Evapotranspiration Studies,
W83-00287 2D

Influence of Prescribed Burning on Nutrient Budgets of Mountain Fynbos Catchments in the S. W. Cape, Rep. of South Africa,
W83-00304 5B

SOUTHWESTERN KANSAS
Geohydrology of Southwestern Kansas,
W83-00059 7C

SOYBEANS
Dendrography for Optimal Water and Energy Utilization in Plant Growth,
W83-00265 3F

SPECIES COMPOSITION
The Structure and Some Recent Changes of the Zoobenthic Community in the Ermatinger Becken, A Shallow Littoral Part of Lake Constance,
W83-00036 2H

Species Composition and Distribution of Zooplankton in a Tropical Lake, Lake Naivasha, Kenya,
W83-00056 5B

Paleolimnology of Lake Isle, Alberta, Canada (Including Sediment Chemistry, Pigments and Diatom Stratigraphy),
W83-00316 2H

SPECIES DIVERSITY
Correlation of Rotifer Associations in a Chain of Lakes Fed by Reclaimed Sewage,
W83-00023 5G

SPECTRAL ANALYSIS
Dissolved Organic Carbon and UV-Absorption in a Polluted Lowland Brook-Pond System,
W83-00024 5G

SPECTROPHOTOMETRY
Determination of Boron in River Water with Flameless Atomic Absorption Spectrometry (Graphite Furnace Technique),
W83-00047 5A

Determination of Iron in Natural Waters and Plant Material with 1,10-Phenanthroline by Flow Injection Analysis,
W83-00194 5A

Preconcentration of Environmental Tin and its Determination Using Catechol Violet,
W83-00348 5A

SPECTROSCOPY
Pre-Concentration Technique for Cold-Vapour Atomic-Fluorescence Determination of Mercury in Drinking Waters,
W83-00195 5A

The Chemical Composition of Water and the Analytical Chemist: A Challenge,
W83-00290 5A

SPIRIT LAKE
Existence of Phytoplankton in Spirit Lake Near Active Volcano Mt. St. Helens, Washington, U.S.A.: Post-Eruption Findings,
W83-00026 5C

SPRINKLER IRRIGATION
Water Saving Techniques,
W83-00309 3F

ST. LOUIS BAY
Heavy Metals in Oysters and Clams of St. Louis Bay, Mississippi,
W83-00159 5C

STABILIZATION PONDS
Algal Concentration and Species Composition in Experimental Maturation Ponds with Effects of Aeration and Recirculation,
W83-00284 5D

STABLE ISOTOPES
Chemical and Isotopic Composition of Water from Thermal and Mineral Springs of Washington,
W83-00112 2K

STACHASTIC HYDROLOGY
Application to the Des Moines River of Multiple Reservoir Operating Strategies Incorporating Short-and Long-Term Information in Real Time,
W83-00248 4A

STANDARDS
Solid Waste Management in South Africa,
W83-00090 5G

STANDING CROPS
An Integrated Study on Littoral and Pelagic Primary Production in a Southern African Coastal Lake,
W83-00053 5C

STANDPIPES
Water Storage.
W83-00340 8C

STATISTICAL ANALYSIS
Investigation of Trends in Flooding in the Tug Fork Basin of Kentucky, Virginia, and West Virginia,
W83-00128 4A

Wastewater Management Problems in Rural Communities,
W83-00249 5G

Dendrography for Optimal Water and Energy Utilization in Plant Growth,
W83-00265 3F

STATISTICAL METHODS
The Probability Distribution of Water Inputs and the Economic Benefits of Supplementary Irrigation,
W83-00016 6A

Hydrology and Water Resources of the Drakensberg,
W83-00085 4A

The Statistics of Extreme Values and the Analyses of Floods in South Africa,
W83-00089 2E

A Study of Trends in Total Phosphorus Measurements at Nasqan Stations,
W83-00126 5B

STOCHASTIC PROCESS
Stochastic Daily Precipitation Modeling and Daily Streamflow Transfer Processes,
W83-00282 2E

STOMATAL TRANSPIRATION
Seasonal Progressions in the Water Relations of Deciduous and Evergreen Perennials in the Northern California Chaparral,
W83-00307 2I

STORAGE TANKS
Water Storage.
W83-00340 8C

STORM RUNOFF
Hydrologic Data for Urban Storm Runoff from Nine Sites in the Denver Metropolitan Area, Colorado,
W83-00077 7C

Stormwater Runoff Treatment by Impoundment: Barrhaven Pilot Study,
W83-00083 5D

STORM SEWERS
Drainage and Structures.
W83-00334 8A

STORM WASTEWATER
Stormwater Runoff Treatment by Impoundment: Barrhaven Pilot Study,
W83-00083 5D

STORM WATER
Stormwater Runoff Treatment by Impoundment: Barrhaven Pilot Study,
W83-00083 5D

Management and Control Technology for Urban Stormwater Pollution,
W83-00148 5G

STORMWATER
Coliform Attachment to Suspended Particles in Stormwater,
W83-00224 5B

STRAIN GAGES
Dendrography for Optimal Water and Energy Utilization in Plant Growth,
W83-00265 3F

STREAM DISCHARGE
Water-Quality Assessment of Steiner Branch Basin, Lafayette County, Wisconsin,
W83-00123 4A

STREAM GAGES
Manual for Leveling at Gaging Stations in North Carolina,
W83-00065 7B

STREAM POLLUTION
Non-Point Pollution Control for Rangeland Wintering, Livestock Operations (Ground Cover),
W83-00252 5G

STREAMFLOW
Low-Flow Characteristics and Flow Duration of New Jersey Streams,
W83-00061 7C

Report of the Annual Yield of the Arkansas River Basin for the Arkansas River Basin Compact, Arkansas--Oklahoma, 1980 Water Year,
W83-00063 4A

Floodflow Characteristics Related to Channel Geometry in Ohio,
W83-00067 2E

Perennial-Streamflow Characteristics Related to Channel Geometry and Sediment in Missouri River Basin,
W83-00121 4D

Streamflows and Channels of the Green River Basin, Wyoming,
W83-00122 4A

Water-Quality Assessment of Steiner Branch Basin, Lafayette County, Wisconsin,
W83-00123 4A

Assessment of the Usefulness of Hydrologic Data for Hydropower Feasibility Analysis,
W83-00251 2E

Water Yield Changes Resulting from Treatment of Arizona Chaparral,
W83-00303 3B

STREAMS
Low Flow of Streams in Fairfax County, Virginia,
W83-00062 4C

Geohydrologic Descriptions of Selected Solid-Waste Disposal Sites,
W83-00072 5B

Summary Appraisals of the Nation's Ground-Water Resources--New England Region,
W83-00120 4B

SUBMERGED PLANTS
The Ecological Effects of 2-Methylthiotriazine Herbicides used for Aquatic Weed Control in Navigable Canals, II. Effects on Macroinvertebrate Fauna, and General Discussion,
W83-00343 5C

SUCCESSION
Dynamics of Phytoplankton in Finnish Lakes,
W83-00153 5C

SULFUR
Determination of Organophosphorus and Organosulphur at the Sub-NG-Level for Use in Water Analysis,
W83-00046 5A

SULFUR COMPOUNDS
Effects of the Burrowing Mayfly, Hexagenia, on Nitrogen and Sulfur Fractions in Lake Sediment Microcosms,
W83-00030 5C

SURFACE-GROUNDWATER RELATIONS
An Appraisal of Surface-Water Quality in the Alameda Creek Basin, California, October 1974-June 1979,
W83-00064 5B

Water Resources of the Rincon and Mesilla Valleys and Adjacent Areas, New Mexico,
W83-00078 7C

SURFACE RUNOFF
Runoff and Sedimentation Potentials Influenced by Litter and Slope on a Chaparral Community in Central Arizona,
W83-00301 4D

SURFACE WATER
Water Resources Data, Louisiana, Water Year 1981--Volume 2. Southern Louisiana.
W83-00057 7C

An Appraisal of Surface-Water Quality in the Alameda Creek Basin, California, October 1974-June 1979,
W83-00064 5B

Water-Resources Investigations of the U.S. Geological Survey in New Mexico, Fiscal Year 1980.
W83-00073 7A

Quality of Surface Water at Selected Sites in the Suwannee River Basin, Florida, 1980,
W83-00113 7C

Water Resources Data for New York, Water Year 1981--Volume 3. Western New York.
W83-00131 7C

Water Resources Data for North Carolina, Water Year 1981.
W83-00132 7C

The Effects of Excessive Nitrogen and Phosphorus in Surface Waters of a Prairie Marsh,
W83-00266 5G

SURFACE WATER AVAILABILITY
Efficient Use of Water for Irrigation in the Upper Midwest,
W83-00242 3F

SURFACTANTS
Mineralization of Linear Alcohol Ethoxylates and Linear Alcohol Ethoxy Sulfates at Trace Concentrations in Estuarine Water,
W83-00211 5B

Algae Removal by Induced Air Flotation,
W83-00277 5G

SURVEYS
Hazardous Waste Technology Transfer Assessment,
W83-00276 5E

SUSPENDED SOLIDS
Components Contributing to Light Extinction in Natural Water: Method of Isolation,
W83-00213 5A

Coliform Attachment to Suspended Particles in Stormwater,
W83-00224 5B

Cause of Inefficient Solids Separation in the Activated Sludge Process,
W83-00232 5D

Secondary Treatment.
W83-00325 5D

Water Supply and Treatment, Section C-1, Raw Water Preparation.
W83-00335 5F

Primary Treatment.
W83-00337 5D

SWEDEN
Paleoecological Studies of the Recent Development of the Lake Vaxjosjon. IV. Interpretation of the Eutrophication Process Through the Analysis of Subfossil Chironomids,
W83-00028 5C

Induction of High Phosphatase Activity by Aluminum in Acid Lakes,
W83-00029 5B

Characterization of Acid Phosphatases in the Acidified Lake Gardsjon, Sweden,
W83-00050 5C

SWITZERLAND
Limnological Investigations of a Mountain Spring Pond in the Swiss National Park,
W83-00034 2H

SYNTHESIS
Development of Novel Porous Substrates for Ultrafiltration, Desalination and Water Reclamation--Part III,
W83-00259 3A

A Study of Glow Discharge Polymerization as a Means of Preparing Composite Reverse Osmosis Membranes with Ultrathin Skin,
W83-00260 3A

SYSTEMS ANALYSIS
Rural Water Supply Systems: Improved Planning Strategies Through Systems Analysis,
W83-00241 6A

TASTE
Disinfection, Taste and Odor Control.
W83-00341 5F

TAXES
Lump Sum Tax Loss Reimbursement Under the Thames River Flood Control Compact,
W83-00005 6B

TECHNOLOGY TRANSFER
Lake Restoration Technology Transfer Assessment,
W83-00215 5G

A Cooperative Water Resource Technology Transfer Program,
W83-00216 6B

A Curriculum for Water Supply and Wastewater Operation, Maintenance and Management,
W83-00247 5G

Hazardous Waste Technology Transfer Assessment,
W83-00276 5E

TEMPORAL DISTRIBUTION
Climatic Aspects of Droughts,
W83-00188 3F

TENNESSEE
Installation and Sampling of Observation Wells and Analyses of Water from the Shallow Aquifer at Selected Waste-Disposal Sites in the Memphis Area, Tennessee,
W83-00066 5B

TERBUTRYNE
The Ecological Effects of 2-Methylthiotriazine Herbicides used for Aquatic Weed Control in Navigable Canals, II. Effects on Macroinvertebrate Fauna, and General Discussion,
W83-00343 5C

TERRAIN ANALYSIS
The Analyses of Areal Rainfall Using Multi-Quadric Surfaces,
W83-00088 2B

TERTIARY WASTEWATER TREATMENT
Advanced Treatment.
W83-00151 5D

TESTING PROCEDURES
Simple Control Tests for Operators of Small Wastewater Treatment Plants,
W83-00092 5D

TEXAS
The Ogallala--Half Full or Half Empty.,
W83-00017 6D

Distribution of Chironomids in the Littoral Zone of Lake Texoma, Oklahoma and Texas,
W83-00031 2H

Approximately Water-Level Changes in Wells in the Chicot and Evangeline Aquifers 1977-82 and 1981-82, and Measured Compaction 1973-82, in the Houston-Galveston Region, Texas,
W83-00075 7C

TEXTILE MILL WASTES
Textile Industry Wastewater Treatment by Air Flotation,
W83-00080 5D

THE NETHERLANDS
Some Notes on the Ecology of Aquatic Oligochaetes in the Delta Region of the Netherlands,
W83-00035 2L

Metal Binding Capacity in Relation to Hydrology and Algal Periodicity in Tjeukemeer, the Netherlands,
W83-00039 5B

The Aerobic Mineralization of Amino Acids in the Saline Lake Grevelingen and the Freshwater Haringvliet Basin (The Netherlands),
W83-00178 5C

Phosphate and Wind in a Shallow Lake,
W83-00184 5B

THEORETICAL ANALYSIS
The Statistics of Extreme Values and the Analyses of Floods in South Africa,
W83-00089 2E

THERMAL SPRINGS
Chemical and Isotopic Composition of Water from Thermal and Mineral Springs of Washington,
W83-00112 2K

THERMAL WATER
The Hydrothermal System in Southern Grass Valley, Pershing County, Nevada,
W83-00060 4B

Methods for Collection and Analysis of Geopressured Geothermal and Oil Field Waters,
W83-00127 2K

THERORETICAL ANALYSIS
The Analyses of Areal Rainfall Using Multi-Quadric Surfaces,
W83-00088 2B

THIN FILMS
Development of Chlorine Resistant Membranes, Polyimide Membranes and Porous Substrates,
W83-00246 3A

A Study of Glow Discharge Polymerization as a Means of Preparing Composite Reverse Osmosis Membranes with Ultrathin Skin,
W83-00260 3A

THORIUM
Observations on the Bioaccumulation Potential of Thorium and Uranium in Rainbow Trout (Salmo Gairdneri),
W83-00021 5C

THUNDERSTORMS
The USLE Rainfall Factor for Southwestern U. S. Rangelands,
W83-00098 4D

TILE DRAINAGE
Nitrate Movement and Denitrification Defined Relative to Bromide Tracer in Tile-Drained Land,
W83-00264 5B

TIN
Preconcentration of Environmental Tin and its Determination Using Catechol Violet,
W83-00348 5A

TISBE HOLOTHURIAE
Impact of Chromium to the Population Dynamics of Tisbe Holothuriae,
W83-00043 5C

TOPOGRAPHIC MAPPING
Soil Maps of Montana,
W83-00237 7C

TOXICITY
Impact of Chromium to the Population Dynamics of Tisbe Holothuriae,
W83-00043 5C

Bioassay Technique for Relative Toxicity in Water Pollution Control,
W83-00146 5A

The Fate of 2,4,6-Trichlorophenol in an Aquatic Continuous-Flow System,
W83-00332 5B

TOXINS
Adsorption of Toxic and Carcinogenic Compounds from Water,
W83-00171 5F

TRAINING
Manual for Leveling at Gaging Stations in North Carolina,
W83-00065 7B

TRANSPIRATION
Water Yield Changes Resulting from Treatment of Arizona Chaparral,
W83-00303 3B

TREATED WATER
Polycyclic Aromatic Hydrocarbons in Sewage, Mussels and Tap Water,
W83-00330 5B

TREATMENT FACILITIES
Sludge Disposal from Acid Mine Drainage Treatment,
W83-00298 5E

TRICKLE IRRIGATION
Water Saving Techniques,
W83-00309 3F

TRICKLING FILTERS
High-Quality Trickling Filter Effluent Without Tertiary Treatment,
W83-00142 5D

Fixed-Film Biological Processes,
W83-00191 5D

TROPICAL REGIONS
The Chemistry and Phytoplankton of the Orinoco and Caroni Rivers, Venezuela,
W83-00187 5B

Assessment of Low Head, Micro Hydroelectric Equipment for Use on Small Tropical Islands,
W83-00268 8C

TROUT
Observations on the Bioaccumulation Potential of Thorium and Uranium in Rainbow Trout (Salmo Gairdneri),
W83-00021 5C

TUG FORK BASIN
Investigation of Trends in Flooding in the Tug Fork Basin of Kentucky, Virginia, and West Virginia,
W83-00128 4A

TURBULENT FLOW
Phosphate and Wind in a Shallow Lake,
W83-00184 5B

ULTRAFILTRATION
Development of Novel Porous Substrates for Ultrafiltration, Desalination and Water Reclamation--Part III,
W83-00259 3A

ULTRASONICS
Non-Contacting Ultrasonic for Flow and Level Control,
W83-00221 5D

UNITED KINGDOM
Chemical Surveillance of Rivers,
W83-00134 5A

Kielder - Planning to Meet the Future.
W83-00207 8A

The Effects of the Disposal of Sewage Effluents on Groundwater Quality in the United Kingdom,
W83-00220 5E

URANIUM
Observations on the Bioaccumulation Potential of Thorium and Uranium in Rainbow Trout (Salmo Gairdneri),
W83-00021 5C

URBAN DRAINAGE
Estimating Runoff Volumes from Urban Areas,
W83-00007 4A

Adaptation of the ILLUDAS Model to a Desktop Computer,
W83-00081 7B

URBAN PLANNING
Water Resource System Reliability Under Drought Conditions: The Seattle Water Supply System as a Case Study,
W83-00229 3D

URBAN RUNOFF
Adaptation of the ILLUDAS Model to a Desktop Computer,
W83-00081 7B

Management and Control Technology for Urban Stormwater Pollution,
W83-00148 5G

Reevaluation of the Effects of Deicing Salt Runoff on a Small Urban Lake,
W83-00227 5C

URBAN WATERSHEDS
Water Quality in Urban Streams--What we can Expect,
W83-00144 5C

URBANIZATION
Low Flow of Streams in Fairfax County, Virginia,
W83-00062 4C

USER CHARGES
Metering, Monitoring and Quality Control.
W83-00336 8G

UTAH
A Test of the USLE on Bare and Sagebrush Plots in Utah,
W83-00101 4D

Final Environmental Impact Statement of the White River Dam Project.
W83-00297 6G

VASCULAR TISSUES
Storage of Carbon and Transport of Oxygen in River Macrophytes: Mass-Balance, and the Measurement of Primary Productivity in Rivers,
W83-00051 5B

VENEZUELA
The Chemistry and Phytoplankton of the Orinoco and Caroni Rivers, Venezuela,
W83-00187 5B

VERMONT
Rainfall-Runoff Characteristics for a Mountainous Watershed in the Northeast United States,
W83-00347 2A

VERTICAL DISTRIBUTION
The Development of Attenuance Depth-Profiling to Follow the Changing Distribution of Phytoplankton and Other Particulate Material in a Productive English Lake,
W83-00055 5C

VIBRIO
The Incidence of Vibrio Cholerae in Water, Animals and Birds in Kent, England,
W83-00012 5B

VIRGINIA
Low Flow of Streams in Fairfax County, Virginia,
W83-00062 4C

VOLATILE ACIDS
Anaerobic Digestion of Free Volatile Fatty Acids in Soils Below Waste Tips,
W83-00326 5D

VOLATILE ORGANIC COMPOUNDS
Control Measures for Groundwater VOCS,
W83-00199 5F

VOLCANOES
Existence of Phytoplankton in Spirit Lake Near Active Volcano Mt. St. Helens, Washington, U.S.A.: Post-Eruption Findings,
W83-00026 5C

Characterization of Organic Contaminants in Environmental Samples Associated with Mount St. Helens 1980 Volcanic Eruption,
W83-00161 5A

WAHIAWA RESERVOIR
Water Quality Simulation of Wahiawa Reservoir, O'Ahu, Hawaii,
W83-00281 5G

WALES
Accuracy of Determination of Ammoniacal Nitrogen in River Waters: Analytical Quality Control in the Harmonised Monitoring Scheme.
W83-00196 5A

WASHINGTON
Existence of Phytoplankton in Spirit Lake Near Active Volcano Mt. St. Helens, Washington, U.S.A.: Post-Eruption Findings,
W83-00026 5C

Chemical and Isotopic Composition of Water from Thermal and Mineral Springs of Washington,
W83-00112 2K

Characterization of Organic Contaminants in Environmental Samples Associated with Mount St. Helens 1980 Volcanic Eruption,
W83-00161 5A

WASTE DISPOSAL
Installation and Sampling of Observation Wells and Analyses of Water from the Shallow Aquifer at Selected Waste-Disposal Sites in the Memphis Area, Tennessee,
W83-00066 5B

Hazardous Waste Technology Transfer Assessment,
W83-00276 5E

WASTE DISPOSAL WELLS
Hydrogeology and Results of Injection Tests at Waste-Injection Test Sites in Pinellas County, Florida,
W83-00129 5B

WASTE MANAGEMENT
Water and Waste Management in the Canadian Meat and Poultry Processing Industry.
W83-00082 3E

Solid Waste Management in South Africa,
W83-00090 5G

Geologic Criteria in Waste-Management Site Selection in Northeastern North Dakota,
W83-00236 5E

WASTE TREATMENT
Stabilizing High-Strength Wastes with Photosynthetic Bacteria,
W83-00181 5D

WASTEWATER
An Appraisal of Surface-Water Quality in the Alameda Creek Basin, California, October 1974-June 1979,
W83-00064 5B

WASTEWATER ANALYSIS
Determination of Benzidines by Gas Chromatographic Separation of Derivatives with Electron Capture Detection,
W83-00182 5A

Comparison of Sulfide-Selective Electrode and Gas-Stripping Monitors for Hydrogen Sulfide in Effluents,
W83-00204 5A

Determination of Benzidines in Industrial and Municipal Wastewaters,
W83-00292 5A

WASTEWATER COLLECTION
Manpower Needs in Wastewater Treatment and Collection Systems for the Years 1980 to 2000,
W83-00180 5G

WASTEWATER DISPOSAL
The Effects of the Disposal of Sewage Effluents on Groundwater Quality in the United Kingdom,
W83-00220 5E

WASTEWATER FACILITIES
Operation Control.
W83-00155 5G

Control Operations and Maintenance Services.
W83-00157 5D

Cause of Inefficient Solids Separation in the Activated Sludge Process,
W83-00232 5D

The Laurel Run Acid Mine Drainage Renovation Demonstration Facility: An Evaluation,
W83-00258 5G

WASTEWATER FARMING
Application of Remote Sensing in Evaluating Floodwater Farming on the Papago Indian Reservation,
W83-00230 3F

WASTEWATER MANAGEMENT
Trade Effluent Control and the Microprocessor,
W83-00003 5G

Nutrient Removal From Wastewater by Wetlands,
W83-00226 5D

A Curriculum for Water Supply and Wastewater Operation, Maintenance and Management,
W83-00247 5G

Wastewater Management Problems in Rural Communities,
W83-00249 5G

WASTEWATER POLLUTION
Some Aspects of the Colonization by Water Mites (Acari, Actinedida) of an Artifical Substrate in a Disturbed Environment,
W83-00054 5C

WASTEWATER RENOVATION
Correlation of Rotifer Associations in a Chain of Lakes Fed by Reclaimed Sewage,
W83-00023 5G

The Laurel Run Acid Mine Drainage Renovation Demonstration Facility: An Evaluation,
W83-00258 5G

The Effects of Excessive Nitrogen and Phosphorus in Surface Waters of a Prairie Marsh,
W83-00266 5G

Potential Applications of Water Hyacinth for Water, Air Recycling in Closed Systems,
W83-00324 5G

WASTEWATER TREATMENT
Textile Industry Wastewater Treatment by Air Flotation,
W83-00080 5D

Stormwater Runoff Treatment by Impoundment: Barrhaven Pilot Study,
W83-00083 5D

Simple Control Tests for Operators of Small Wastewater Treatment Plants,
W83-00092 5D

The Use of Oxygen to Uprate the Treatment Capacity of a Conventional Surface-Aeration Plant at Holdenhurst (Bournemouth) Sewage Treatment Works,
W83-00133 5D

A Simulation Study on the Operation of Laboratory Scale Anaerobic Digesters,
W83-00138 5D

Biooxidation of Paint Process Wastewater,
W83-00143 5D

Recycling of Mercury and Silver from COD Tests,
W83-00145 5D

Adenosine Triphosphate as a Control Parameter for Activated Sludge Processes,
W83-00149 5D

Improvements in Foam Flotation for Lead Removal,
W83-00150 5D

Advanced Treatment.
W83-00151 5D

Sludge Digestion and Disposal.
W83-00152 5D

Disinfection, Odor Prevention and Control.
W83-00154 5D

Pulp and Paper Effluent Management,
W83-00164 5D

Removing Soluble Organic Contaminants by Lime-Softening,
W83-00172 5F

Improvement in Coal Preparation-Water Clarification Through Polymer Flocculation,
W83-00177 5D

Effect of Activated Sludge Operational Conditions on Sludge Thickening Characteristics,
W83-00179 5D

Manpower Needs in Wastewater Treatment and Collection Systems for the Years 1980 to 2000,
W83-00180 5G

Water Management in the Oil Shale Industry,
W83-00185 5D

Digester Control Pays Dividends,
W83-00192 5D

Effect of a Bacterial Culture Product on Biological Kinetics,
W83-00212 5D

Non-Contacting Ultrasonic for Flow and Level Control,
W83-00221 5D

Cause of Inefficient Solids Separation in the Activated Sludge Process,
W83-00232 5D

Wastewater Flocculation-Filtration and Post Disinfection,
W83-00239 5D

High pH Stabilization of Wastewater Sludge Using Chemical Softening Wastes From Water Treatment,
W83-00243 5D

Wastewater Management Problems in Rural Communities,
W83-00249 5G

Algal Concentration and Species Composition in Experimental Maturation Ponds with Effects of Aeration and Recirculation,
W83-00284 5D

Evaluation and Control of Sidestreams Generated in Publicly Owned Treatment Works,
W83-00291 5D

Sludge Disposal from Acid Mine Drainage Treatment,
W83-00298 5E

Instrumental Methods of Monitoring and Control of Water and Wastewater Treatment Processes,
W83-00314 5F

Preliminary Studies on the Treatment of Canning Factory Effluent with an Integrated Bacterial-Algal-Fish System,
W83-00317 5D

Treatment of Oily Wastewaters from Onshore Operations,
W83-00319 5D

Water Quality Criteria and Effluent Requirements in Broward County, Florida,
W83-00320 5G

The Influence of Process Parameters on the Removal of Heavy Metals in Activated Sludge,
W83-00327 5D

Advanced Biological Treatment to Achieve Nutrient Removal,
W83-00349 5D

Municipal Pretreatment Program Development,
W83-00350 5D

WASTEWATER TREATMENTS
Investigations on Cellulose Biodegradation in Activated Sludge Plants,
W83-00013 5D

WATER ALLOCATION
Analysis of Legal and Institutional Arrangements Affecting Water Allocation and Use in Nebraska,
W83-00250 6E

WATER ANALYSIS
Simple Control Tests for Operators of Small Wastewater Treatment Plants,
W83-00092 5D

Determination of Benzidines by Gas Chromatographic Separation of Derivatives with Electron Capture Detection,
W83-00182 5A

Determination of Iron in Natural Waters and Plant Material with 1,10-Phenanthroline by Flow Injection Analysis,
W83-00194 5A

Pre-Concentration Technique for Cold-Vapour Atomic-Fluorescence Determination of Mercury in Drinking Waters,
W83-00195 5A

Reevaluation of the Effects of Deicing Salt Runoff on a Small Urban Lake,
W83-00227 5C

Hazardous Pollutant Analysis in Water Using Infrared Spectroscopy,
W83-00231 5A

A Curriculum for Water Supply and Wastewater Operation, Maintenance and Management,
W83-00247 5G

Anoxic Nutrient Regeneration and the Eutrophication of Estuarine Waters,
W83-00263 5C

A Preliminary Study of Natural Aquifer Discharge of Guam,
W83-00271 5B

The Chemical Composition of Water and the Analytical Chemist: A Challenge,
W83-00290 5A

Determination of Benzidines in Industrial and Municipal Wastewaters,
W83-00292 5A

Increasing Arcat Test Sensitivity for Examination of Potable Waters,
W83-00293 5F

Preconcentration of Environmental Tin and its Determination Using Catechol Violet,
W83-00348 5A

WATER CONSERVATION
Social and Political Aspects of Drought,
W83-00186 6B

Incentives for Irrigation Water Conservation in Agriculture,
W83-00278 3F

Conservation Through Crops Research,
W83-00311 3F

WATER CONVEYANCE
Chemical Stability of Water.
W83-00091 5F

Rural Water Supply Systems: Improved Planning Strategies Through Systems Analysis,
W83-00241 6A

WATER COSTS
High Plains - Ogallala Aquifer Study Water Transfer Element,
W83-00312 4A

WATER DISTRIBUTION
Mains and Services.
W83-00313 8C

Instrumental Methods of Monitoring and Control of Water and Wastewater Treatment Processes,
W83-00314 5F

Water Storage.
W83-00340 8C

WATER EFFICIENCY
Variability in Crop Physiological and Morphological Characteristics Controlling Water Use Efficiency and Grain Yield,
W83-00234 3F

WATER HYACINTH
Potential Applications of Water Hyacinth for Water, Air Recycling in Closed Systems,
W83-00324 5G

WATER LAW
Lump Sum Tax Loss Reimbursement Under the Thames River Flood Control Compact,
W83-00005 6B

Law,
W83-00165 6E

Water Law Primer,
W83-00318 6E

WATER LEVEL
Manual for Leveling at Gaging Stations in North Carolina,
W83-00065 7B

WATER LEVEL FLUCTUATIONS
Approximately Water-Level Changes in Wells in the Chicot and Evangeline Aquifers 1977-82 and 1981-82, and Measured Compaction 1973-82, in the Houston-Galveston Region, Texas,
W83-00075 7C

WATER MAINS
Cathodic Protection of Water Mains,
W83-00175 8G

Mains and Services.
W83-00313 8C

Collection Systems.
W83-00338 8C

System Maintenance.
W83-00339 8A

WATER MANAGEMENT
The Nation's Water,
W83-00004 6D

Water and Waste Management in the Canadian Meat and Poultry Processing Industry.
W83-00082 3E

Water Management in the Oil Shale Industry,
W83-00185 5D

Climatic Aspects of Droughts,
W83-00188 3F

High Plains-Ogallala Aquifer Study, New Mexico -- Economic Impacts,
W83-00308 6B

WATER MEASUREMENT
Metering, Monitoring and Quality Control.
W83-00336 8G

WATER METERING
Metering, Monitoring and Quality Control.
W83-00336 8G

WATER POLLUTION
Geohydrologic Descriptions of Selected Solid-Waste Disposal Sites,
W83-00072 5B

A Curriculum for Water Supply and Wastewater Operation, Maintenance and Management,
W83-00247 5G

WATER POLLUTION CONTROL
A Study of Trends in Total Phosphorus Measurements at Nasqan Stations,
W83-00126 5B

Management and Control Technology for Urban Stormwater Pollution,
W83-00148 5G

Water Quality Standards and Water Quality,
W83-00162 5G

Water Law Primer,
W83-00318 6E

Treatment of Oily Wastewaters from Onshore Operations,
W83-00319 5D

WATER POLLUTION EFFECTS
Municipal Point Source and Agricultural Nonpoint Source Contribution to Coastal Eutrophication,
W83-00001 5B

Correlation of Rotifer Associations in a Chain of Lakes Fed by Reclaimed Sewage,
W83-00023 5G

Guidelines for Surface Water Quality: Vol 1: Inorganic Chemical Substances: Copper,
W83-00079 5G

Water Characteristics,
W83-00169 5B

An Overview of Acid Rain Monitoring Activities in North America,
W83-00189 5C

Polynuclear Aromatic Hydrocarbons and Cellular Proliferative Disorders in Bivalue Molluscs from Oregon Estuaries,
W83-00295 5C

The Ecological Effects of 2-Methylthiotriazine Herbicides used for Aquatic Weed Control in Navigable Canals, II. Effects on Macroinvertebrate Fauna, and General Discussion,
W83-00343 5C

WATER POLLUTION PREVENTION
The Clean Water Act's Section 404 Permit Program Enters its Adolescence: An Institutional and Programmatic Perspective,
W83-00210 5G

WATER POLLUTION SOURCES
Municipal Point Source and Agricultural Nonpoint Source Contribution to Coastal Eutrophication,
W83-00001 5B

Water Quality of Streams in the Great Smoky Mountains National Park,
W83-00032 5B

Stream Water Nutrient Changes Associated with the Conversion of Arizona Chaparral,
W83-00300 5B

WATER PURIFICATION
Determination of Organic Contaminants in Ultra-Pure Water by Reversed-Phase High-Performance Liquid Chromatography with Ultraviolet Detection,
W83-00202 5A

WATER QUALITY
Water Resources Data, Louisiana, Water Year 1981--Volume 2. Southern Louisiana.
W83-00057 7C

Carroll County Ground-Water Information: Well Records, Spring Records, and Chemical-Quality Data.
W83-00058 7C

An Appraisal of Surface-Water Quality in the Alameda Creek Basin, California, October 1974-June 1979,
W83-00064 5B

Installation and Sampling of Observation Wells and Analyses of Water from the Shallow Aquifer at Selected Waste-Disposal Sites in the Memphis Area, Tennessee,
W83-00066 5B

Effects of Effluent Spray Irrigation on Ground Water at a Test Site Near Tarpon Springs, Florida,
W83-00068 5B

Geohydrologic Descriptions of Selected Solid-Waste Disposal Sites,
W83-00072 5B

Selected Hydrogeologic Data from Southern Sweet Grass County, South-Central Montana,
W83-00076 7C

Hydrologic Data for Urban Storm Runoff from Nine Sites in the Denver Metropolitan Area, Colorado,
W83-00077 7C

Water Resources of the Rincon and Mesilla Valleys and Adjacent Areas, New Mexico,
W83-00078 7C

Quality of Surface Water at Selected Sites in the Suwannee River Basin, Florida, 1980,
W83-00113 7C

Deep Artesian Aquifers of Sanibel and Captiva Islands, Lee County, Florida,
W83-00114 4B

Water-Quality Assessment of Steiner Branch Basin, Lafayette County, Wisconsin,
W83-00123 4A

Water-Quality Characteristics of Six Small, Semiarid Watersheds in the Green River Coal Region of Colorado,
W83-00124 5A

Designation of Principal Water-Supply Aquifers in Minnesota,
W83-00125 2F

A Study of Trends in Total Phosphorus Measurements at Nasqan Stations,
W83-00126 5B

Hydrogeology and Results of Injection Tests at Waste-Injection Test Sites in Pinellas County, Florida,
W83-00129 5B

Water Resources Data for New York, Water Year 1981--Volume 3. Western New York.
W83-00131 7C

Water Resources Data for North Carolina, Water Year 1981.
W83-00132 7C

Water Characteristics,
W83-00169 5B

U.S. Geological Survey Federal-State Program,
W83-00201 6E

A Cooperative Water Resource Technology Transfer Program,
W83-00216 6B

Coliform Attachment to Suspended Particles in Stormwater,
W83-00224 5B

Influence of Prescribed Burning on Nutrient Budgets of Mountain Fynbos Catchments in the S. W. Cape, Rep. of South Africa,
W83-00304 5B

WATER QUALITY CONTROL
Mass Balance Model Estimation of Phosphorus Concentrations in Reservoirs,
W83-00009 5C

Simple Control Tests for Operators of Small Wastewater Treatment Plants,
W83-00092 5D

Phosphate and Wind in a Shallow Lake,
W83-00184 5B

Water Quality Criteria and Effluent Requirements in Broward County, Florida,
W83-00320 5G

WATER QUALITY MANAGEMENT
Water Quality of Streams in the Great Smoky Mountains National Park,
W83-00032 5B

Water Quality Simulation of Wahiawa Reservoir, O'Ahu, Hawaii,
W83-00281 5G

WATER QUALITY STANDARDS
Guidelines for Surface Water Quality: Vol 1: Inorganic Chemical Substances: Copper,
W83-00079 5G

New EPA Sodium and Corrosion Regulations: Their Basis and Impacts,
W83-00137 5G

Water Quality in Urban Streams--What we can Expect,
W83-00144 5C

Water Quality Standards and Water Quality,
W83-00162 5G

Developing and Applying International Water Quality Guidelines,
W83-00167 5G

Nitrate Contamination of Groundwater on the Old Mission Peninsula: Contribution of Land Reshaping and Septic Drainfields,
W83-00228 5B

WATER RENOVATION
Water Reclamation and Reuse,
W83-00163 5D

WATER RESOURCE DEVELOPMENT
Case Study Analyses of 208 Program Effectiveness in Improving Regional Water Resources Management,
W83-00240 6B

WATER RESOURCES DEVELOPMENT
Environmental Impact of Large Hydroelectric Projects on Tropical Countries,
W83-00010 6G

Irrigation Planning in the Tana Basin of Kenya,
W83-00015 6B

Groundwater is the Answer to Zambia's Water Problem,
W83-00225 4B

Remote Sensing of Water Resources on Pacific Islands,
W83-00262 7C

Effective Graphical Display of Water Resource Planning Information for Decision Makers, Volume I,
W83-00273 10D

Effective Graphical Display of Water Resources Planning Information for Decision Makers, Volume II,
W83-00274 10D

Final Environmental Impact Statement of the White River Dam Project.
W83-00297 6G

WATER REUSE
Water Reclamation and Reuse,
W83-00163 5D

WATER RIGHTS
Analysis of Legal and Institutional Arrangements Affecting Water Allocation and Use in Nebraska,
W83-00250 6E

WATER SOFTENING
Softening, Iron and Manganese Removal.
W83-00342 5F

WATER STORAGE
The Water Supply of the Brussels Urban Area and its Surroundings.
W83-00020 5F

Water Storage.
W83-00340 8C

WATER STRESS
Dendrography for Optimal Water and Energy Utilization in Plant Growth,
W83-00265 3F

WATER SUPPLY
The Nation's Water,
W83-00004 6D

The Water Supply of the Brussels Urban Area and its Surroundings.
W83-00020 5F

Water Resources of the Rincon and Mesilla Valleys and Adjacent Areas, New Mexico,
W83-00078 7C

Hydrology and Water Resources of the Drakensberg,
W83-00085 4A

Deep Artesian Aquifers of Sanibel and Captiva Islands, Lee County, Florida,
W83-00114 4B

Designation of Principal Water-Supply Aquifers in Minnesota,
W83-00125 2F

Social and Political Aspects of Drought,
W83-00186 6B

U.S. Geological Survey Federal-State Program,
W83-00201 6E

A Curriculum for Water Supply and Wastewater Operation, Maintenance and Management,
W83-00247 5G

Water Treatment for Small Public Supplies,
W83-00280 5F

Water Quality Simulation of Wahiawa Reservoir, O'Ahu, Hawaii,
W83-00281 5G

Blackheath Water Treatment Plant,
W83-00283 5F

Estimating Hydrologic Values for Planning Wildland Fire Protection,
W83-00306 6B

WATER SUPPLY DEVELOPMENT
Water Resource System Reliability Under Drought Conditions: The Seattle Water Supply System as a Case Study,
W83-00229 3D

WATER SUPPLY SYSTEMS
Water Resource System Reliability Under Drought Conditions: The Seattle Water Supply System as a Case Study,
W83-00229 3D

WATER TEMPERATURE
The Hydrothermal System in Southern Grass Valley, Pershing County, Nevada,
W83-00060 4B

WATER TRANSFER
An Alternative to the Peripheral Canal,
W83-00193 6G

High Plains - Ogallala Aquifer Study Water Transfer Element,
W83-00312 4A

WATER TRANSPORT
Large Water Transport Pumps,
W83-00206 8C

WATER TREATMENT
The Water Supply of the Brussels Urban Area and its Surroundings.
W83-00020 5F

Dissolved Organic Carbon and UV-Absorption in a Polluted Lowland Brook-Pond System,
W83-00024 5G

Chemical Stability of Water.
W83-00091 5F

Rapid-Mix Design for Mechanisms of Alum Coagulation,
W83-00170 5F

Adsorption of Toxic and Carcinogenic Compounds from Water,
W83-00171 5F

Removing Soluble Organic Contaminants by Lime-Softening,
W83-00172 5F

West River Gets Innovative Technology,
W83-00197 5F

New Technology for Drinking Water Treatment,
W83-00198 5F

High pH Stabilization of Wastewater Sludge Using Chemical Softening Wastes From Water Treatment,
W83-00243 5D

Water Treatment for Small Public Supplies,
W83-00280 5F

Blackheath Water Treatment Plant,
W83-00283 5F

Increasing Arcat Test Sensitivity for Examination of Potable Waters,
W83-00293 5F

Instrumental Methods of Monitoring and Control of Water and Wastewater Treatment Processes,
W83-00314 5F

Water Supply and Treatment, Section C-1, Raw Water Preparation.
W83-00335 5F

WATER TREATMENT FACILITIES
Design and Construction of the Pennichuck Water Treatment Plant: The Engineer's View,
W83-00135 5F

Design and Construction of the Pennichuck Water Treatment Plant: The Construction Manager's View,
W83-00136 5F

Non-Contacting Ultrasonic for Flow and Level Control,
W83-00221 5D

Blackheath Water Treatment Plant,
W83-00283 5F

WATER USE
U.S. Geological Survey Federal-State Program,
W83-00201 6E

Analysis of Legal and Institutional Arrangements Affecting Water Allocation and Use in Nebraska,
W83-00250 6E

Water Law Primer,
W83-00318 6E

WATER WELLS
Selected Hydrogeologic Data from Southern Sweet Grass County, South-Central Montana,
W83-00076 7C

WATER YIELD
Report of the Annual Yield of the Arkansas River Basin for the Arkansas River Basin Compact, Arkansas--Oklahoma, 1980 Water Year,
W83-00063 4A

WATER YIELD IMPROVEMENT
Angora Goats for Conversion of Arizona Chaparral: Early Results,
W83-00299 3B

Stream Water Nutrient Changes Associated with the Conversion of Arizona Chaparral,
W83-00300 5B

Water Yield Changes Resulting from Treatment of Arizona Chaparral,
W83-00303 3B

WATERSHED MANAGEMENT
Water Quality of Streams in the Great Smoky Mountains National Park,
W83-00032 5B

Testing the Modified Universal Soil Loss Equation,
W83-00107 4D

Water Yield Changes Resulting from Treatment of Arizona Chaparral,
W83-00303 3B

WATERSHEDS
IIHR Distrubuted Parameter Watershed Model,
W83-00269 2E

Measurement and Mapping of Potential Evapotranspiration in a Small Mountainous Watershed,
W83-00346 2D

Rainfall-Runoff Characteristics for a Mountainous Watershed in the Northeast United States,
W83-00347 2A

WEATHER FORECASTING
A Depth-Duration-Frequency Diagram for Point Rainfall in Swa-Namibia,
W83-00289 2B

WELL WATER
Use of Fracture Traces in Water Well Location: a Handbook.
W83-00217 4B

WELLS
Approximately Water-Level Changes in Wells in the Chicot and Evangeline Aquifers 1977-82 and 1981-82, and Measured Compaction 1973-82, in the Houston-Galveston Region, Texas,
W83-00075 7C

WEST GERMANY
Differential Pulse Polarography of Some Herbicides Derived From 2,4-Dichlorophenoxyacetic Acid, II. Determination of Herbicide Residues in Irrigation Waters,
W83-00045 5A

The Sediments of the New Artificial Lake Bostalsee (Saarland, Germany), with Particular Reference to Microbial Activity,
W83-00048 5C

Bacterioplankton Affected by Phosphorus Precipitation Treatment in a Polytrophic Lake,
W83-00315 5G

WETLANDS
Nutrient Removal From Wastewater by Wetlands,
W83-00226 5D

WHITE RIVER
Final Environmental Impact Statement of the White River Dam Project.
W83-00297 6G

WILDLIFE HABITATS
The Ecology of the Mangroves of South Florida: A Community Profile,
W83-00093 6G

WIND VELOCITY
Phosphate and Wind in a Shallow Lake,
W83-00184 5B

WISCONSIN
Water-Quality Assessment of Steiner Branch Basin, Lafayette County, Wisconsin,
W83-00123 4A

WYOMING
Streamflows and Channels of the Green River Basin, Wyoming,
W83-00122 4A

Instream Salmonid Habitat Exclusion by Ice-Cover,
W83-00257 8I

ZAMBIA
Groundwater is the Answer to Zambia's Water Problem,
W83-00225 4B

ZOOPLANKTON
Seasonal Variation of Zooplankton of the Veli Lake, South-West Coast of India,
W83-00027 2H

Species Composition and Distribution of Zooplankton in a Tropical Lake, Lake Naivasha, Kenya,
W83-00056 5B

AUTHOR INDEX

AARONSON, S.
The Relationship Between Nutrient Status and Chemical Composition of Peridinium Cinctum During the Bloom in Lake Kinneret,
W83-00333 5C

ABBOTT, M. R.
In Situ Response of Phytoplankton Fluorescence to Rapid Variations in Light,
W83-00141 5C

ACKMAN, T. E.
Sludge Disposal from Acid Mine Drainage Treatment,
W83-00298 5E

ADAMSON, P. T.
The Analyses of Areal Rainfall Using Multi-Quadric Surfaces,
W83-00088 2B

The Statistics of Extreme Values and the Analyses of Floods in South Africa,
W83-00089 2E

ADOLPHSON, D. G.
Designation of Principal Water-Supply Aquifers in Minnesota,
W83-00125 2F

AHERN, J.
Evaluation of Limnological Parameters as Related to the Success of Mysis Relicta Introductions,
W83-00254 8I

AHMAD, I.
Determination of Pyrazon Residues in Water by Reversed Phase High Performance Liquid Chromatography,
W83-00014 5A

ALLANSON, B. R.
An Integrated Study on Littoral and Pelagic Primary Production in a Southern African Coastal Lake,
W83-00053 5C

ALLEN, R. V.
Geohydrology of the Valley-Fill Aquifer in the Corning Area, Steuben County, New York,
W83-00117 7C

Geohydrology of the Valley-Fill Aquifer in the Schenectady Area, Schenectady County, New York,
W83-00116 7C

ALM, J. L.
Increasing Arcat Test Sensitivity for Examination of Potable Waters,
W83-00293 5F

AMBROISE, B.
Measurement and Mapping of Potential Evapotranspiration in a Small Mountainous Watershed,
W83-00346 2D

AMIRTHARAJAH, A.
Rapid-Mix Design for Mechanisms of Alum Coagulation,
W83-00170 5F

ANDEEN, G. B.
Development and Demonstration of a Reverse-Osmosis Energy-Recovery Device,
W83-00256 3A

ANDERSON, C. E.
Efficient Use of Water for Irrigation in the Upper Midwest,
W83-00242 3F

ANDERSON, C. P.
Hazardous Pollutant Analysis in Water Using Infrared Spectroscopy,
W83-00231 5A

ANDERSON, H. R.
Geohydrology of the Valley-Fill Aquifer in the South Fallsburgh-Woodbourne Area, Sullivan County, New York,
W83-00069 7C

ANDERSON, H. W.
Estimating Hydrologic Values for Planning Wildland Fire Protection,
W83-00306 6B

ANDERSON, R. J. JR.
The Probability Distribution of Water Inputs and the Economic Benefits of Supplementary Irrigation,
W83-00016 6A

ARBITBLIT, D. C.
The Plight of American Citizens Injured by Transboundary River Pollution,
W83-00209 6E

ARNAC, P.
A New Method of Leak Detection in Distribution Systems Under Pressure: Acoustic Correlation,
W83-00205 8G

ARNDT, B. M.
Geologic Criteria in Waste-Management Site Selection in Northeastern North Dakota,
W83-00236 5E

ARNELL, V.
Estimating Runoff Volumes from Urban Areas,
W83-00007 4A

ARUNACHALAM, M.
Seasonal Variation of Zooplankton of the Veli Lake, South-West Coast of India,
W83-00027 2H

ASLAM, S.
Recycling of Mercury and Silver from COD Tests,
W83-00145 5D

AUSTIN, A. E.
Development of New Chemical Additives and Treatments for Scale Control in Saline Water Evaporators,
W83-00222 3A

AUSTIN, T. A.
Efficient Use of Water for Irrigation in the Upper Midwest,
W83-00242 3F

Rural Water Supply Systems: Improved Planning Strategies Through Systems Analysis,
W83-00241 6A

BABCOCK, W. C.
Development of Composite Hollow Fibers - Phase III,
W83-00267 3A

BAKER, J. L.
Nitrate Movement and Denitrification Defined Relative to Bromide Tracer in Tile-Drained Land,
W83-00264 5B

BAKER, R. W.
Development of Composite Hollow Fibers - Phase III,
W83-00267 3A

BALAKRISHNAN NAIR, N.
Seasonal Variation of Zooplankton of the Veli Lake, South-West Coast of India,
W83-00027 2H

BALASUBRAMANIAN, N. K.
Seasonal Variation of Zooplankton of the Veli Lake, South-West Coast of India,
W83-00027 2H

BALL, R.
Evaluation and Control of Sidestreams Generated in Publicly Owned Treatment Works,
W83-00291 5D

BARSS, R. P.
Development of Composite Hollow Fibers - Phase III,
W83-00267 3A

BASHFORD, D. J.
The Incidence of Vibrio Cholerae in Water, Animals and Birds in Kent, England,
W83-00012 5B

BAXTER, K. M.
The Effects of the Disposal of Sewage Effluents on Groundwater Quality in the United Kingdom,
W83-00220 5E

BEARD, K. V.
Non-Contacting Ultrasonic for Flow and Level Control,
W83-00221 5D

BECKFORD, S.
Tracing Well Water Pollution in a Limestone Aquifer,
W83-00173 5B

BELL, G. R.
Diatomite Precoat Filtration for Pretreatment of Seawater Prior to Reverse Osmosis,
W83-00270 3A

BELLI, J. L.
Geohydrology of the Valley-Fill Aquifer in the Corning Area, Steuben County, New York,
W83-00117 7C

Geohydrology of the Valley-Fill Aquifer in the South Fallsburgh-Woodbourne Area, Sullivan County, New York,
W83-00069 7C

BENTZ, A. P.
Hazardous Pollutant Analysis in Water Using Infrared Spectroscopy,
W83-00231 5A

BERG, B. M.
Soil Characterization and Alternate Shoreline Erosion Control Measures for Constructed Lakes in Iowa,
W83-00218 4D

BERGLIND, L.
Adsorption of PAH to Aquatic Humus,
W83-00038 5B

BERMAN, T.
The Relationship Between Nutrient Status and Chemical Composition of Peridinium Cinctum During the Bloom in Lake Kinneret,
W83-00333 5C

BERTENSHAW, M. P.
Pre-Concentration Technique for Cold-Vapour Atomic-Fluorescence Determination of Mercury in Drinking Waters,
W83-00195 5A

BEVERS, J.
Investigations on Cellulose Biodegradation in Activated Sludge Plants,
W83-00013 5D

BHAGAT, S. K.
Adenosine Triphosphate as a Control Parameter for Activated Sludge Processes,
W83-00149 5D

BISCHOFBERGER, H.
Wastewater Flocculation-Filtration and Post Disinfection,
W83-00239 5D

BLIGHT, G. E.
The Flow of Slurry from a Breached Tailings Dam,
W83-00285 8B

BLUMER, S. P.
Hydrologic Data for the Alluvium and Terrace Aquifer of the Beaver-North Canadian River from the Panhandle to Canton Reservoir, Northwestern Oklahoma,
W83-00110 7C

BLUMM, M. C.
The Clean Water Act's Section 404 Permit Program Enters its Adolescence: An Institutional and Programmatic Perspective,
W83-00210 5G

BOGGESS, D. H.
Deep Artesian Aquifers of Sanibel and Captiva Islands, Lee County, Florida,
W83-00114 4B

BOKN, T.
Polycyclic Aromatic Hydrocarbons in Sewage, Mussels and Tap Water,
W83-00330 5B

BORST, R. J.
Anaerobic Digestion of Free Volatile Fatty Acids in Soils Below Waste Tips,
W83-00326 5D

BOTES, P. J.
Stabilizing High-Strength Wastes with Photosynthetic Bacteria,
W83-00181 5D

BOWEN, H. J. M.
Preconcentration of Environmental Tin and its Determination Using Catechol Violet,
W83-00348 5A

BRAND, J. G.
Blackheath Water Treatment Plant,
W83-00283 5F

BRIGGS, R.
Instrumental Methods of Monitoring and Control of Water and Wastewater Treatment Processes,
W83-00314 5F

BROBERG, O.
Characterization of Acid Phosphatases in the Acidified Lake Gardsjon, Sweden,
W83-00050 5C

BROCK, J. H.
Runoff and Sedimentation Potentials Influenced by Litter and Slope on a Chaparral Community in Central Arizona,
W83-00301 4D

BRODIN, Y.
Paleoecological Studies of the Recent Development of the Lake Vaxjosjon. IV. Interpretation of the Eutrophication Process Through the Analysis of Subfossil Chironomids,
W83-00028 5C

BROWN, D. P.
Effects of Effluent Spray Irrigation on Ground Water at a Test Site Near Tarpon Springs, Florida,
W83-00068 5B

BROWN, G. A.
Geohydrology of the Valley-Fill Aquifer in the Schenectady Area, Schenectady County, New York,
W83-00116 7C

BROWN, J. A. JR.
Biooxidation of Paint Process Wastewater,
W83-00143 5D

BRYANT, J. O. JR.
Manpower Needs in Wastewater Treatment and Collection Systems for the Years 1980 to 2000,
W83-00180 5G

BUCHANAN, T. J.
U.S. Geological Survey Federal-State Program,
W83-00201 6E

BURDICK, C. R.
Advanced Biological Treatment to Achieve Nutrient Removal,
W83-00349 5D

BURFORD, J. B.
Hydrologic Data for Experimental Agricultural Watersheds in the United States, 1973,
W83-00095 7C

BURGER, C. P.
Dendrography for Optimal Water and Energy Utilization in Plant Growth,
W83-00265 3F

BURGESS, S. J.
Water Resource System Reliability Under Drought Conditions: The Seattle Water Supply System as a Case Study,
W83-00229 3D

BURTON, G. W.
Groundwater is the Answer to Zambia's Water Problem,
W83-00225 4B

BUSCH, A. W.
Bioassay Technique for Relative Toxicity in Water Pollution Control,
W83-00146 5A

CABASSO, I.
Development of Novel Porous Substrates for Ultrafiltration, Desalination and Water Reclamation--Part III,
W83-00259 3A

CADDY, D. E.
Practical Techniques of River Monitoring and Pollution Forecasting,
W83-00238 5B

CALABRESE, E. J.
Seasonal Changes of Dissolved Sodium in the Connecticut River Near Northfield, Massachusetts,
W83-00139 5B

CALKIN, H. W.
Seasonal Progressions in the Water Relations of Deciduous and Evergreen Perennials in the Northern California Chaparral,
W83-00307 2I

CAMPBELL, E.
Plumbline Monitor Interface,
W83-00094 8G

CAMPER, N. D.
Aerobic Degradation of Diuron by Aquatic Microorganisms,
W83-00002 5B

CARLSON, R. E.
Stratigaphic Diatom and Chemical Evidence for Acid Strip-Mine Lake Recovery,
W83-00329 2H

CAROTHERS, W. W.
Methods for Collection and Analysis of Geopressured Geothermal and Oil Field Waters,
W83-00127 2K

CARY, L. E.
Selected Hydrologic and Climatologic Data from the Prairie Dog Creek Basin, Southeastern Montana, Water Year 1980,
W83-00074 7C

CHANG, T. J.
Stochastic Daily Precipitation Modeling and Daily Streamflow Transfer Processes,
W83-00282 2E

CHANG, T. P.
Excretion and DOC Utilization by Oscillatoria Rubescens D.C. and its Accompanying Micro-Organisms,
W83-00183 5C

CHAPMAN, P. M.
Design of Monitoring Studies for Priority Pollutants,
W83-00321 7A

CHOINSKI, E. M.
Some Variations in Distribution of Fishes in Large Mainstream Reservoirs Associated with Artificial Cover,
W83-00255 8I

CHRISTENSON, S. C.
Hydrologic Data for the Alluvium and Terrace Aquifer of the Beaver-North Canadian River from the Panhandle to Canton Reservoir, Northwestern Oklahoma,
W83-00110 7C

CHRISTMAN, R. F.
Structural Characterization of Aquatic Humic Material,
W83-00190 5C

CLEVELAND, J. M.
Characterization of Plutonium in Ground Water Near the Idaho Chemical Processing Plant,
W83-00019 5B

CLOETE, T. E.
Preliminary Studies on the Treatment of Canning Factory Effluent with an Integrated Bacterial-Algal-Fish System,
W83-00317 5D

Stabilizing High-Strength Wastes with Photosynthetic Bacteria,
W83-00181 5D

COFFIN, J. E.
Quality of Surface Water at Selected Sites in the Suwannee River Basin, Florida, 1980,
W83-00113 7C

COHON, J. L.
Reservoir Management in Potomac River Basin,
W83-00203 6A

CONTRACTOR, D. N.
Assessment of Low Head, Micro Hydroelectric Equipment for Use on Small Tropical Islands,
W83-00268 8C

Remote Sensing of Water Resources on Pacific Islands,
W83-00262 7C

CONWAY, M. F.
Heavy Metal Interactions and Dynamics in Simulated Naugatuck River Microcosms,
W83-00214 5B

COOKE, G. D.
Control of Lake Phosphorus with Aluminum Sulfate: Dose Determination and Application Techniques,
W83-00006 5C

COOKE, M. G.
Comparison of Sulfide-Selective Electrode and Gas-Stripping Monitors for Hydrogen Sulfide in Effluents,
W83-00204 5A

COOLEY, R. V.
Municipal Pretreatment Program Development,
W83-00350 5D

COONEY, J. J.
Microorganisms Capable of Degrading Refractory Hydrocarbons in Ohio Waters,
W83-00219 5B

CORBUS, F. G.
Aquatic Weed Control with Endothall in a Salt River Project Canal,
W83-00166 4A

COX, W. E.
Water Law Primer,
W83-00318 6E

CROLEY, T. E. II.
IIHR Distrubuted Parameter Watershed Model,
W83-00269 2E

CROWLEY, K. D.
Large-Scale Bedforms in the Platte River Downstream from Grand Island, Nebraska: Structure Process, and Relationship to Channel Narrowing,
W83-00111 4D

CURTIN, S. E.
Map Showing the Potentiometric Surface of the Magothy Aquifer in Southern Maryland, September 1981,
W83-00115 7C

D'ITRI, F. M.
A Cooperative Water Resource Technology Transfer Program,
W83-00216 6B

DAGUE, R. R.
High pH Stabilization of Wastewater Sludge Using Chemical Softening Wastes From Water Treatment,
W83-00243 5D

DANIELS, M. L.
High-Quality Trickling Filter Effluent Without Tertiary Treatment,
W83-00142 5D

DASCHBACH, M. H.
Lake Restoration Technology Transfer Assessment,
W83-00215 5G

DAVIS, C. B.
The Effects of Excessive Nitrogen and Phosphorus in Surface Waters of a Prairie Marsh,
W83-00266 5G

DAVIS, D. R.
The Role of Hydrologic Variability in Complying with Regulatory Enforcement Standards for the Rehabilitation of Surface-Mined Coal Lands,
W83-00223 6G

DAVIS, E. A.
Stream Water Nutrient Changes Associated with the Conversion of Arizona Chaparral,
W83-00300 5B

Water Yield Changes Resulting from Treatment of Arizona Chaparral,
W83-00303 3B

DAVIS, R. E.
Hydrologic Data for the Alluvium and Terrace Aquifer of the Beaver-North Canadian River from the Panhandle to Canton Reservoir, Northwestern Oklahoma,
W83-00110 7C

DE BOER, T.
Metal Binding Capacity in Relation to Hydrology and Algal Periodicity in Tjeukemeer, the Netherlands,
W83-00039 5B

DE GROOT, W. T.
Phosphate and Wind in a Shallow Lake,
W83-00184 5B

DE HAAN, H.
Metal Binding Capacity in Relation to Hydrology and Algal Periodicity in Tjeukemeer, the Netherlands,
W83-00039 5B

DEBANO, L. F.
Runoff and Sedimentation Potentials Influenced by Litter and Slope on a Chaparral Community in Central Arizona,
W83-00301 4D

DEENY, K.
Evaluation and Control of Sidestreams Generated in Publicly Owned Treatment Works,
W83-00291 5D

DELLEUR, J. W.
Stochastic Daily Precipitation Modeling and Daily Streamflow Transfer Processes,
W83-00282 2E

DEMAYO, A.
Guidelines for Surface Water Quality: Vol 1: Inorganic Chemical Substances: Copper,
W83-00079 5G

DEPETRIS, P. J.
A Principal Components Analysis of the Phytoplankton from a Pond in the Parana River Valley, Argentina,
W83-00022 5C

DEPINTO, J. V.
An Evaluation of the Recovery of Adirondack Acid Lakes by Chemical Manipulation,
W83-00245 5G

DESOUZA, A.
Increasing Arcat Test Sensitivity for Examination of Potable Waters,
W83-00293 5F

DEWEZ, A.
Some Aspects of the Colonization by Water Mites (Acari, Actinedida) of an Artifical Substrate in a Disturbed Environment,
W83-00054 5C

DIAMOND, J.
Lump Sum Tax Loss Reimbursement Under the Thames River Flood Control Compact,
W83-00005 6B

DICK, R. I.
Cause of Inefficient Solids Separation in the Activated Sludge Process,
W83-00232 5D

DICKEY, J.
Role of Fungi in Postfire Stabilization of Chaparral Ash Beds,
W83-00302 4D

DICKMAN, M. D.
The Recent Histories of Three Canadian Shield Lakes: A Paleolimnological Experiment,
W83-00042 5C

DIERING, J. A. C.
The Flow of Slurry from a Breached Tailings Dam,
W83-00285 8B

DINEEN, R. J.
Geohydrology of the Valley-Fill Aquifer in the South Fallsburgh-Woodbourne Area, Sullivan County, New York,
W83-00069 7C

DISSMEYER, G. E.
Developing a USLE Cover-Management (C) Factor Procedure for Forest Conditions,
W83-00108 4D

DIVAKARAN, O.
Seasonal Variation of Zooplankton of the Veli Lake, South-West Coast of India,
W83-00027 2H

DIXON, J. E.
Non-Point Pollution Control for Rangeland Wintering, Livestock Operations (Ground Cover),
W83-00252 5G

DONOVAN, T. J.
The Incidence of Vibrio Cholerae in Water, Animals and Birds in Kent, England,
W83-00012 5B

DRAPER, S. H.
Water Resource System Reliability Under Drought Conditions: The Seattle Water Supply System as a Case Study,
W83-00229 3D

DREWS, R. J. L. C.
Simple Control Tests for Operators of Small Wastewater Treatment Plants,
W83-00092 5D

DU TOIT, P. J.
Stabilizing High-Strength Wastes with Photosynthetic Bacteria,
W83-00181 5D

DUCRET, G. L. JR.
Report of the Annual Yield of the Arkansas River Basin for the Arkansas River Basin Compact, Arkansas--Oklahoma, 1980 Water Year,
W83-00063 4A

DUDA, A. M.
Municipal Point Source and Agricultural Nonpoint Source Contribution to Coastal Eutrophication,
W83-00001 5B

Water Quality in Urban Streams--What we can Expect,
W83-00144 5C

DUNN, J. R.
Determination of Benzidines by Gas Chromatographic Separation of Derivatives with Electron Capture Detection,
W83-00182 5A

DUNN, P. H.
Role of Fungi in Postfire Stabilization of Chaparral Ash Beds,
W83-00302 4D

DURAN, R. M.
Water Treatment for Small Public Supplies,
W83-00280 5F

EASTLIN, J. D.
Variability in Crop Physiological and Morphological Characteristics Controlling Water Use Efficiency and Grain Yield,
W83-00234 3F

EATON, J. W.
The Ecological Effects of 2-Methylthiotriazine Herbicides used for Aquatic Weed Control in Navigable Canals, II. Effects on Macroinvertebrate Fauna, and General Discussion,
W83-00343 5C

EDZWALD, J. K.
An Evaluation of the Recovery of Adirondack Acid Lakes by Chemical Manipulation,
W83-00245 5G

EIBLING, J. A.
Development of New Chemical Additives and Treatments for Scale Control in Saline Water Evaporators,
W83-00222 3A

EID, J. C.
Development and Demonstration of a Reverse-Osmosis Energy-Recovery Device,
W83-00256 3A

ELLIS, B. G.
Nitrate Contamination of Groundwater on the Old Mission Peninsula: Contribution of Land Reshaping and Septic Drainfields,
W83-00228 5B

ELLIS, P. A.
Aerobic Degradation of Diuron by Aquatic Microorganisms,
W83-00002 5B

ENGELBRECHT, A. H.
The Occurrence of a Fungal Parasite on a Tetraselmis (Prasinophyceae) Species,
W83-00288 5C

ENGMAN, E. T.
Rainfall-Runoff Characteristics for a Mountainous Watershed in the Northeast United States,
W83-00347 2A

EVANS, W. C.
Chemical and Isotopic Composition of Water from Thermal and Mineral Springs of Washington,
W83-00112 2K

FELTIS, R. D.
Selected Hydrogeologic Data from Southern Sweet Grass County, South-Central Montana,
W83-00076 7C

FENLON, J. S.
Chemical Surveillance of Rivers,
W83-00134 5A

FENTON, T.
Nitrate Movement and Denitrification Defined Relative to Bromide Tracer in Tile-Drained Land,
W83-00264 5B

FERRY, W. K.
Case Study Analyses of 208 Program Effectiveness in Improving Regional Water Resources Management,
W83-00240 6B

FIELD, S. J.
Water-Quality Assessment of Steiner Branch Basin, Lafayette County, Wisconsin,
W83-00123 4A

FILLER, J. R.
Assessment of the Usefulness of Hydrologic Data for Hydropower Feasibility Analysis,
W83-00251 2E

FINNEMORE, E. J.
Management and Control Technology for Urban Stormwater Pollution,
W83-00148 5G

FIUTEM, R. A.
Determination of Benzidines by Gas Chromatographic Separation of Derivatives with Electron Capture Detection,
W83-00182 5A

FOGEL, M. M.
The Role of Hydrologic Variability in Complying with Regulatory Enforcement Standards for the Rehabilitation of Surface-Mined Coal Lands,
W83-00223 6G

FOSHEE, W. C.
Improvement in Coal Preparation-Water Clarification Through Polymer Flocculation,
W83-00177 5D

FOSTER, G. R.
Estimating Sediment Yield from Rangeland with CREAMS,
W83-00103 2J

Relation of USLE Factors to Erosion on Rangeland,
W83-00096 2J

Special Problems in the Application of the USLE to Rangelands: C and P Factors,
W83-00100 2J

FOUTCH, R.
Increasing Arcat Test Sensitivity for Examination of Potable Waters,
W83-00293 5F

FOX, R. L.
Development of Chlorine Resistant Membranes, Polyimide Membranes and Porous Substrates,
W83-00246 3A

FRANCIS, C. A.
Variability in Crop Physiological and Morphological Characteristics Controlling Water Use Efficiency and Grain Yield,
W83-00234 3F

FREMPONG, E.
Diel Periodicity in the Chemical Composition of Lake Phytoplankton,
W83-00049 5B

FRENZEL, P.
The Structure and Some Recent Changes of the Zoobenthic Community in the Ermatinger Becken, A Shallow Littoral Part of Lake Constance,
W83-00036 2H

FRITZ, S. C.
Stratigaphic Diatom and Chemical Evidence for Acid Strip-Mine Lake Recovery,
W83-00329 2H

FURNISS, A. L.
The Incidence of Vibrio Cholerae in Water, Animals and Birds in Kent, England,
W83-00012 5B

GAIGHER, I. G.
Preliminary Studies on the Treatment of Canning Factory Effluent with an Integrated Bacterial-Algal-Fish System,
W83-00317 5D

GANNON, J. J.
Coliform Attachment to Suspended Particles in Stormwater,
W83-00224 5B

GARCIA DE EMILIANI, M. O.
A Principal Components Analysis of the Phytoplankton from a Pond in the Parana River Valley, Argentina,
W83-00022 5C

GARD, T. C.
Persistence in Model Ecosystems,
W83-00294 5B

GEBHARDT, K. A.
Predicting Sediment Yields from Sagebrush Rangelands,
W83-00106 4D

Use of Erosion Models on Western Rangelands,
W83-00097 2J

GEIGER, N. S.
Existence of Phytoplankton in Spirit Lake Near Active Volcano Mt. St. Helens, Washington, U.S.A.: Post-Eruption Findings,
W83-00026 5C

GIBBS, J. W.
Hydrologic Data for Urban Storm Runoff from Nine Sites in the Denver Metropolitan Area, Colorado,
W83-00077 7C

GIETA, R. J.
Stormwater Runoff Treatment by Impoundment: Barrhaven Pilot Study,
W83-00083 5D

GILBERT, B. K.
U.S. Geological Survey Federal-State Program,
W83-00201 6E

GILLESPIE, B. D.
Low-Flow Characteristics and Flow Duration of New Jersey Streams,
W83-00061 7C

GILLEY, J. R.
Irrigation Scheduling,
W83-00310 3F

GINOCCHIO, J. C.
Wastewater Flocculation-Filtration and Post Disinfection,
W83-00239 5D

GJESSING, E. T.
Adsorption of PAH to Aquatic Humus,
W83-00038 5B

GMUNDER, A.
Wastewater Flocculation-Filtration and Post Disinfection,
W83-00239 5D

GODDARD, K. E.
Use of Mathematical Models to Predict Impacts of Mining Energy Minerals on the Hydrologic System in Northwestern Colorado,
W83-00168 4C

GOLCHIN, J.
Efficient Use of Water for Irrigation in the Upper Midwest,
W83-00242 3F

GOMEZ-GOMEZ, F.
Geohydrologic Descriptions of Selected Solid-Waste Disposal Sites,
W83-00072 5B

GORE, J. A.
Instream Salmonid Habitat Exclusion by Ice-Cover,
W83-00257 8I

GOVE, G. W.
Pulp and Paper Effluent Management,
W83-00164 5D

GRABOWSKI, J. J.
Evaluation of Limnological Parameters as Related to the Success of Mysis Relicta Introductions,
W83-00254 8I

GRADY, C. P. L. JR.
Effect of Activated Sludge Operational Conditions on Sludge Thickening Characteristics,
W83-00179 5D

GRAHAM, D. D.
Installation and Sampling of Observation Wells and Analyses of Water from the Shallow Aquifer at Selected Waste-Disposal Sites in the Memphis Area, Tennessee,
W83-00066 5B

GRAUER, T.
Nitrate Movement and Denitrification Defined Relative to Bromide Tracer in Tile-Drained Land,
W83-00264 5B

GREEN, G. C.
A Weighing Lysimeter Facility at Roodeplaat for Crop Evapotranspiration Studies,
W83-00287 2D

GREGORY, E. J.
Water-Use Production Functions of Selected Agronomic Crops in Northwestern New Mexico, Phase I,
W83-00235 3F

GREGORY, R. W.
Physicochemical Limnology of the Tongue River Reservoir, Montana,
W83-00033 2H

GRIEPINK, B.
Determination of Organophosphorus and Organosulphur at the Sub-NG-Level for Use in Water Analysis,
W83-00046 5A

GROS, H.
Wastewater Flocculation-Filtration and Post Disinfection,
W83-00239 5D

GULENS, J.
Comparison of Sulfide-Selective Electrode and Gas-Stripping Monitors for Hydrogen Sulfide in Effluents,
W83-00204 5A

GUPTA, G.
Potential Applications of Water Hyacinth for Water, Air Recycling in Closed Systems,
W83-00324 5G

GUTENTAG, E. D.
Geohydrology of Southwestern Kansas,
W83-00059 7C

HAGAN, G. F.
Low Flow of Streams in Fairfax County, Virginia,
W83-00062 4C

HAINES, T. A.
Acidic Precipitation and Its Consequences for Aquatic Ecosystems: A Review,
W83-00331 5C

HALL, R. B.
Dendrography for Optimal Water and Energy Utilization in Plant Growth,
W83-00265 3F

HANBURY, R. G.
The Ecological Effects of 2-Methylthiotriazine Herbicides used for Aquatic Weed Control in Navigable Canals, II. Effects on Macroinvertebrate Fauna, and General Discussion,
W83-00343 5C

HANSFORD, G. S.
A Simulation Study on the Operation of Laboratory Scale Anaerobic Digesters,
W83-00138 5D

HARRIS, M.
Evaluation and Control of Sidestreams Generated in Publicly Owned Treatment Works,
W83-00291 5D

HART, G. E.
A Test of the USLE on Bare and Sagebrush Plots in Utah,
W83-00101 4D

HARTIG, J. H.
Effects of Michigan's Phosphorus Detergent Ban on Municipal Chemical Costs,
W83-00147 5G

HASS, J. R.
Structural Characterization of Aquatic Humic Material,
W83-00190 5C

HATTINGH, W. H. J.
The Chemical Composition of Water and the Analytical Chemist: A Challenge,
W83-00290 5A

HATTULA, M-L.
The Fate of 2,4,6-Trichlorophenol in an Aquatic Continuous-Flow System,
W83-00332 5B

HEDMAN, E. R.
Perennial-Streamflow Characteristics Related to Channel Geometry and Sediment in Missouri River Basin,
W83-00121 4D

HEGEWALD, E.
Investigations on the Lakes of Peru and Their Phytoplankton. 6 Additional Chemical Analyses,
W83-00037 2H

HEISLER, M. D.
Development of Chlorine Resistant Membranes, Polyimide Membranes and Porous Substrates,
W83-00246 3A

HEITZ, L. F.
Assessment of the Usefulness of Hydrologic Data for Hydropower Feasibility Analysis,
W83-00251 2E

HEKMAN, L. H. JR.
The Role of Hydrologic Variability in Complying with Regulatory Enforcement Standards for the Rehabilitation of Surface-Mined Coal Lands,
W83-00223 6G

HENDERSON, K. W.
West River Gets Innovative Technology,
W83-00197 5F

HERRINGTON, H. D.
Comparison of Sulfide-Selective Electrode and Gas-Stripping Monitors for Hydrogen Sulfide in Effluents,
W83-00204 5A

HIBBERT, A. R.
Water Yield Changes Resulting from Treatment of Arizona Chaparral,
W83-00303 3B

HICKEY, J. J.
Hydrogeology and Results of Injection Tests at Waste-Injection Test Sites in Pinellas County, Florida,
W83-00129 5B

HICKMAN, M.
Paleolimnology of Lake Isle, Alberta, Canada (Including Sediment Chemistry, Pigments and Diatom Stratigraphy),
W83-00316 2H

HIGGINS, A. J.
Land Application of Municipal Sludge with Regard to Cropping Systems and Pollution Potential,
W83-00233 5E

HIGGINS, J.
Digester Control Pays Dividends,
W83-00192 5D

HIMES, R. C.
Diatomite Precoat Filtration for Pretreatment of Seawater Prior to Reverse Osmosis,
W83-00270 3A

HINMAN, D. D.
Non-Point Pollution Control for Rangeland Wintering, Livestock Operations (Ground Cover),
W83-00252 5G

HIRSCH, R. M.
Investigation of Trends in Flooding in the Tug Fork Basin of Kentucky, Virginia, and West Virginia,
W83-00128 4A

A Study of Trends in Total Phosphorus Measurements at Nasqan Stations,
W83-00126 5B

HOEKS, J.
Anaerobic Digestion of Free Volatile Fatty Acids in Soils Below Waste Tips,
W83-00326 5D

HOLTMAN, S.
Algae Removal by Induced Air Flotation,
W83-00277 5G

HOOGVELD, H. L.
Metal Binding Capacity in Relation to Hydrology and Algal Periodicity in Tjeukemeer, the Netherlands,
W83-00039 5B

HOPPER, W. M. JR.
Groundwater in the Inner Bluegrass Karst Region, Kentucky,
W83-00275 2F

HORVATH, F. J.
Effects of Michigan's Phosphorus Detergent Ban on Municipal Chemical Costs,
W83-00147 5G

HOWARD, C. C.
Determination of Benzidines in Industrial and Municipal Wastewaters,
W83-00292 5A

HOWARD, R. B.
Erosion and Sedimentation as Part of the Natural System,
W83-00305 2J

HOWARD-WILLIAMS, C.
An Integrated Study on Littoral and Pelagic Primary Production in a Southern African Coastal Lake,
W83-00053 5C

HRUDEY, S. E.
Water Reclamation and Reuse,
W83-00163 5D

HUANG, J. Y. C.
Wastewater Management Problems in Rural Communities,
W83-00249 5G

HULL, J. A.
Annual Peak Discharges from Small Drainage Areas in Montana Through September 1981,
W83-00071 2E

HUNTER, R. M.
Municipal Pretreatment Program Development,
W83-00350 5D

HURLEY, D. G.
Case Study Analyses of 208 Program Effectiveness in Improving Regional Water Resources Management,
W83-00240 6B

HUTCHINSON, C.
Application of Remote Sensing in Evaluating Floodwater Farming on the Papago Indian Reservation,
W83-00230 3F

HUTSON, J. L.
A Weighing Lysimeter Facility at Roodeplaat for Crop Evapotranspiration Studies,
W83-00287 2D

ILMAVIRTA, V.
Dynamics of Phytoplankton in Finnish Lakes,
W83-00153 5C

ISBISTER, J. D.
Increasing Arcat Test Sensitivity for Examination of Potable Waters,
W83-00293 5F

JACKSON, N. M. JR.
Manual for Leveling at Gaging Stations in North Carolina,
W83-00065 7B

JAIN, S. C.
IIHR Distrubuted Parameter Watershed Model,
W83-00269 2E

JANSSEN, H. M. J.
Determination of Organophosphorus and Organosulphur at the Sub-NG-Level for Use in Water Analysis,
W83-00046 5A

JANSSON, M.
Characterization of Acid Phosphatases in the Acidified Lake Gardsjon, Sweden,
W83-00050 5C

Induction of High Phosphatase Activity by Aluminum in Acid Lakes,
W83-00029 5B

JOHNSON, C. W.
Predicting Sediment Yields from Sagebrush Rangelands,
W83-00106 4D

JOHNSON, D. W.
Some Variations in Distribution of Fishes in Large Mainstream Reservoirs Associated with Artificial Cover,
W83-00255 8I

JOHNSON, H. P.
Efficient Use of Water for Irrigation in the Upper Midwest,
W83-00242 3F

Nitrate Movement and Denitrification Defined Relative to Bromide Tracer in Tile-Drained Land,
W83-00264 5B

JOHNSON, J. D.
Selected Hydrologic and Climatologic Data from the Prairie Dog Creek Basin, Southeastern Montana, Water Year 1980,
W83-00074 7C

Structural Characterization of Aquatic Humic Material,
W83-00190 5C

JOHNSON, J. H. JR.
Cause of Inefficient Solids Separation in the Activated Sludge Process,
W83-00232 5D

JOHNSON, L. S.
Instream Salmonid Habitat Exclusion by Ice-Cover,
W83-00257 8I

JONES, R. A.
Water Quality Standards and Water Quality,
W83-00162 5G

JORGENSEN, S. S.
Determination of Iron in Natural Waters and Plant Material with 1,10-Phenanthroline by Flow Injection Analysis,
W83-00194 5A

JOSEPHSON, J.
Fixed-Film Biological Processes,
W83-00191 5D

JUDD, J. H.
Reevaluation of the Effects of Deicing Salt Runoff on a Small Urban Lake,
W83-00227 5C

KAJILA, S.
Incentives for Irrigation Water Conservation in Agriculture,
W83-00278 3F

KALLSON, C. E.
Water-Use Production Functions of Selected Agronomic Crops in Northwestern New Mexico, Phase I,
W83-00235 3F

KANE, G. A.
Seasonal Changes of Dissolved Sodium in the Connecticut River Near Northfield, Massachusetts,
W83-00139 5B

KAVVAS, M. L.
Stochastic Daily Precipitation Modeling and Daily Streamflow Transfer Processes,
W83-00282 2E

KAWAHARA, F. K.
Determination of Benzidines by Gas Chromatographic Separation of Derivatives with Electron Capture Detection,
W83-00182 5A

KEEFE, P. N.
Intensive Flow Monitoring--Cost-Effectiveness with a Quality Edge,
W83-00200 5G

KELLY, M. G.
Storage of Carbon and Transport of Oxygen in River Macrophytes: Mass-Balance, and the Measurement of Primary Productivity in Rivers,
W83-00051 5B

KEMPSTER, P. L.
The Toxicology of Silver Iodide in Relation to its use as a Cloud Seeding Agent,
W83-00084 2B

KENNEDY, R. H.
Control of Lake Phosphorus with Aluminum Sulfate: Dose Determination and Application Techniques,
W83-00006 5C

KHARAKA, Y. K.
Methods for Collection and Analysis of Geopressured Geothermal and Oil Field Waters,
W83-00127 2K

KIMBER, A. R.
The Use of Oxygen to Uprate the Treatment Capacity of a Conventional Surface-Aeration Plant at Holdenhurst (Bournemouth) Sewage Treatment Works,
W83-00133 5D

KINSLEY, R. K.
Social and Political Aspects of Drought,
W83-00186 6B

KINSMAN, J. D.
An Overview of Acid Rain Monitoring Activities in North America,
W83-00189 5C

KITANIDIS, P. K.
Application to the Des Moines River of Multiple Reservoir Operating Strategies Incorporating Short-and Long-Term Information in Real Time,
W83-00248 4A

KLARER, D. M.
Paleolimnology of Lake Isle, Alberta, Canada (Including Sediment Chemistry, Pigments and Diatom Stratigraphy),
W83-00316 2H

KLEIN, J. M.
Characterization of Organic Contaminants in Environmental Samples Associated with Mount St. Helens 1980 Volcanic Eruption,
W83-00161 5A

KLIMPEL, R. R.
Improvement in Coal Preparation-Water Clarification Through Polymer Flocculation,
W83-00177 5D

KNIPE, O. D.
Angora Goats for Conversion of Arizona Chaparral: Early Results,
W83-00299 3B

Water Yield Changes Resulting from Treatment of Arizona Chaparral,
W83-00303 3B

KOOPMAN, R. T.
Design and Construction of the Pennichuck Water Treatment Plant: The Construction Manager's View,
W83-00136 5F

KOTZ, K. T.
Association Studies of Polybrominated Biphenyls in Aquatic Systems,
W83-00160 5B

KOZLOSKI, R. P.
Multiple Purge Techniques for Determining Organic Pollutants in Groundwater,
W83-00158 5A

KRUG, F. J.
Determination of Iron in Natural Waters and Plant Material with 1,10-Phenanthroline by Flow Injection Analysis,
W83-00194 5A

KRUSE-SMITH, B. A.
Development of Composite Hollow Fibers - Phase III,
W83-00267 3A

KUMAR, S.
IIHR Distrubuted Parameter Watershed Model,
W83-00269 2E

KVESETH, K.
Polycyclic Aromatic Hydrocarbons in Sewage, Mussels and Tap Water,
W83-00330 5B

LAFLEN, J. M.
Use of Rainfall Simulators to Determine Parameters for Erosion Prediction,
W83-00102 2J

LAMBERT, B. K.
Incentives for Irrigation Water Conservation in Agriculture,
W83-00278 3F

LAMBRECHTS, J. J.
Adjustment of Soil Limitations,
W83-00286 2G

LANDERS, D. H.
Effects of the Burrowing Mayfly, Hexagenia, on Nitrogen and Sulfur Fractions in Lake Sediment Microcosms,
W83-00030 5C

LANDSBERG, H. E.
Climatic Aspects of Droughts,
W83-00188 3F

LANE, L. J.
Estimating Sediment Yield from Rangeland with CREAMS,
W83-00103 2J

Modeling Erosion in Overland Flow,
W83-00104 4D

LANSFORD, R. R.
High Plains-Ogallala Aquifer Study, New Mexico -- Economic Impacts,
W83-00308 6B

LARSON, D. W.
Existence of Phytoplankton in Spirit Lake Near Active Volcano Mt. St. Helens, Washington, U.S.A.: Post-Eruption Findings,
W83-00026 5C

LARSON, G. L.
Water Quality of Streams in the Great Smoky Mountains National Park,
W83-00032 5B

LASS, D. A.
Lump Sum Tax Loss Reimbursement Under the Thames River Flood Control Compact,
W83-00005 6B

LAUX, C. H.
Large Water Transport Pumps,
W83-00206 8C

LAWRENCE, G. B.
Effects of the Burrowing Mayfly, Hexagenia, on Nitrogen and Sulfur Fractions in Lake Sediment Microcosms,
W83-00030 5C

LEATHE, S. A.
Physicochemical Limnology of the Tongue River Reservoir, Montana,
W83-00033 2H

LEBOEUF, R. J.
Development of Novel Porous Substrates for Ultrafiltration, Desalination and Water Reclamation--Part III,
W83-00259 3A

LECHIEN, A.
Differential Pulse Polarography of Some Herbicides Derived From 2,4-Dichlorophenoxyacetic Acid, II. Determination of Herbicide Residues in Irrigation Waters,
W83-00045 5A

LEE, G. F.
Water Quality Standards and Water Quality,
W83-00162 5G

LEE, J. V.
The Incidence of Vibrio Cholerae in Water, Animals and Birds in Kent, England,
W83-00012 5B

LENAT, D. R.
Littoral and Profundal Macroinvertebrate Communities of a Coastal Brown-Water Lake,
W83-00044 2H

Water Quality in Urban Streams--What we can Expect,
W83-00144 5C

LESTER, J. N.
The Influence of Process Parameters on the Removal of Heavy Metals in Activated Sludge,
W83-00327 5D

LETTENMAIER, D. P.
Water Resource System Reliability Under Drought Conditions: The Seattle Water Supply System as a Case Study,
W83-00229 3D

LEWIS, W. M. R.
The Chemistry and Phytoplankton of the Orinoco and Caroni Rivers, Venezuela,
W83-00187 5B

LIAO, M. Y.
Removing Soluble Organic Contaminants by Lime-Softening,
W83-00172 5F

LIAO, W.
Structural Characterization of Aquatic Humic Material,
W83-00190 5C

LICO, M. S.
Methods for Collection and Analysis of Geopressured Geothermal and Oil Field Waters,
W83-00127 2K

LIDWIN, R. A.
Water-Quality Assessment of Steiner Branch Basin, Lafayette County, Wisconsin,
W83-00123 4A

LINDSAY, B. E.
Lump Sum Tax Loss Reimbursement Under the Thames River Flood Control Compact,
W83-00005 6B

LINGG, A. J.
Non-Point Pollution Control for Rangeland Wintering, Livestock Operations (Ground Cover),
W83-00252 5G

LITTERICK, M. R.
Species Composition and Distribution of Zooplankton in a Tropical Lake, Lake Naivasha, Kenya,
W83-00056 5B

LOBMEYER, D. H.
Geohydrology of Southwestern Kansas,
W83-00059 7C

LOHNES, R. A.
Soil Characterization and Alternate Shoreline Erosion Control Measures for Constructed Lakes in Iowa,
W83-00218 4D

LONG, L. W.
Design and Construction of the Pennichuck Water Treatment Plant: The Engineer's View,
W83-00135 5F

LONSDALE, H. K.
Development of Composite Hollow Fibers - Phase III,
W83-00267 3A

LOPP, L. E.
An Appraisal of Surface-Water Quality in the Alameda Creek Basin, California, October 1974-June 1979,
W83-00064 5B

LOWERY, J. F.
Installation and Sampling of Observation Wells and Analyses of Water from the Shallow Aquifer at Selected Waste-Disposal Sites in the Memphis Area, Tennessee,
W83-00066 5B

LOWHAM, H. W.
Streamflows and Channels of the Green River Basin, Wyoming,
W83-00122 4A

LOWRY, G. S.
Water Quality Simulation of Wahiawa Reservoir, O'Ahu, Hawaii,
W83-00281 5G

LYLE, W. M.
Water Saving Techniques,
W83-00309 3F

LYNARD, W. G.
Management and Control Technology for Urban Stormwater Pollution,
W83-00148 5G

LYSYJ, I.
Treatment of Oily Wastewaters from Onshore Operations,
W83-00319 5D

LYTLE, J. S.
Heavy Metals in Oysters and Clams of St. Louis Bay, Mississippi,
W83-00159 5C

LYTLE, T. F.
Heavy Metals in Oysters and Clams of St. Louis Bay, Mississippi,
W83-00159 5C

MAAREN, H.
Soil Survey of the Experimental Catchments Near Bethlehem,
W83-00087 4D

MACK, F. K.
Map Showing the Potentiometric Surface of the Magothy Aquifer in Southern Maryland, September 1981,
W83-00115 7C

MADDAUS, W. O.
Case Study Analyses of 208 Program Effectiveness in Improving Regional Water Resources Management,
W83-00240 6B

MAES, L.
Dissolved Organic Carbon and UV-Absorption in a Polluted Lowland Brook-Pond System,
W83-00024 5G

MAHON, K. I.
Geohydrology of the Valley-Fill Aquifer in the Schenectady Area, Schenectady County, New York,
W83-00116 7C

MAINPRIZE, G.
Comparison of Sulfide-Selective Electrode and Gas-Stripping Monitors for Hydrogen Sulfide in Effluents,
W83-00204 5A

MALES, R. M.
Effective Graphical Display of Water Resource Planning Information for Decision Makers, Volume I,
W83-00273 10D

Effective Graphical Display of Water Resources Planning Information for Decision Makers, Volume II,
W83-00274 10D

MARINER, R. H.
Chemical and Isotopic Composition of Water from Thermal and Mineral Springs of Washington,
W83-00112 2K

MARRO, C. A.
Hazardous Waste Technology Transfer Assessment,
W83-00276 5E

MARSALEK, J.
Adaptation of the ILLUDAS Model to a Desktop Computer,
W83-00081 7B

MAVIS, J. D. JR.
Water Management in the Oil Shale Industry,
W83-00185 5D

MAVUTI, K. M.
Species Composition and Distribution of Zooplankton in a Tropical Lake, Lake Naivasha, Kenya,
W83-00056 5B

MCCOOL, D. K.
Effects of Slope Length and Steepness on Soil Erosion from Rangelands,
W83-00099 2J

MCCRAY, K.
The Nation's Water,
W83-00004 6D

The Ogallala--Half Full or Half Empty.,
W83-00017 6D

MCCULLOUGH, P. J.
Determination of Benzidines by Gas Chromatographic Separation of Derivatives with Electron Capture Detection,
W83-00182 5A

MCHUGH, R.
West River Gets Innovative Technology,
W83-00197 5F

MCIVOR, C. C.
The Ecology of the Mangroves of South Florida: A Community Profile,
W83-00093 6G

MCKEE, M. E.
Development of Chlorine Resistant Membranes, Polyimide Membranes and Porous Substrates,
W83-00246 3A

MEANS, J. L.
Development of New Chemical Additives and Treatments for Scale Control in Saline Water Evaporators,
W83-00222 3A

MEDINE, A. J.
Heavy Metal Interactions and Dynamics in Simulated Naugatuck River Microcosms,
W83-00214 5B

MEIER, M. F.
Continuity Equation Model of the Predicted Drastic Retreat of Columbia Glacier, Alaska,
W83-00119 2C

MERCIER, J. L.
Measurement and Mapping of Potential Evapotranspiration in a Small Mountainous Watershed,
W83-00346 2D

MEYER, V. R.
Determination of Organic Contaminants in Ultra-Pure Water by Reversed-Phase High-Performance Liquid Chromatography with Ultraviolet Detection,
W83-00202 5A

MEYERS, M.
Investigations on Cellulose Biodegradation in Activated Sludge Plants,
W83-00013 5D

MILLER, J. F.
Development of New Chemical Additives and Treatments for Scale Control in Saline Water Evaporators,
W83-00222 3A

MILLER, T. S.
Geohydrology of the Valley-Fill Aquifer in the Corning Area, Steuben County, New York,
W83-00117 7C

MILLER, W. J.
Case Study Analyses of 208 Program Effectiveness in Improving Regional Water Resources Management,
W83-00240 6B

MILLINGTON, D. S.
Structural Characterization of Aquatic Humic Material,
W83-00190 5C

MILLS, K. M.
Rapid-Mix Design for Mechanisms of Alum Coagulation,
W83-00170 5F

MITCHELL, M. J.
Effects of the Burrowing Mayfly, Hexagenia, on Nitrogen and Sulfur Fractions in Lake Sediment Microcosms,
W83-00030 5C

MIX, M. C.
Polynuclear Aromatic Hydrocarbons and Cellular Proliferative Disorders in Bivalue Molluscs from Oregon Estuaries,
W83-00295 5C

MOESLUND, B.
Storage of Carbon and Transport of Oxygen in River Macrophytes: Mass-Balance, and the Measurement of Primary Productivity in Rivers,
W83-00051 5B

MOHLER, E. H. JR.
Low Flow of Streams in Fairfax County, Virginia,
W83-00062 4C

MOORE, J. W.
Seasonal Abundance of Ceratium Hirundinella, (O.F. Muller) Schrank in Lakes of Different Trophy,
W83-00052 5C

MOORE, R. B.
Geohydrology of the Valley-Fill Aquifer in the Schenectady Area, Schenectady County, New York,
W83-00116 7C

MOORE, S. F.
Water Quality Simulation of Wahiawa Reservoir, O'Ahu, Hawaii,
W83-00281 5G

MOOSBURNER, O.
Potential Flood and Debris Hazards at Cottonwood Cove, Lake Mead National Recreation Area, Clark County, Nevada,
W83-00070 2E

MORAITOU-APOSTOLOPOULOU, M.
Impact of Chromium to the Population Dynamics of Tisbe Holothuriae,
W83-00043 5C

MORAN, S. R.
Geologic Criteria in Waste-Management Site Selection in Northeastern North Dakota,
W83-00236 5E

MORTATTI, J.
Determination of Iron in Natural Waters and Plant Material with 1,10-Phenanthroline by Flow Injection Analysis,
W83-00194 5A

MUELLER, D. K.
Mass Balance Model Estimation of Phosphorus Concentrations in Reservoirs,
W83-00009 5C

MULHOLLAND, P. J.
Transport of Organic Carbon to the Oceans by Rivers of North America: A Synthesis of Existing Data,
W83-00174 5B

MUNNICH, K. O.
Factors Controlling Stable Isotope Composition of European Precipitation,
W83-00176 2B

MURPHY, K. J.
The Ecological Effects of 2-Methylthiotriazine Herbicides used for Aquatic Weed Control in Navigable Canals, II. Effects on Macroinvertebrate Fauna, and General Discussion,
W83-00343 5C

NAJJAR, G.
Measurement and Mapping of Potential Evapotranspiration in a Small Mountainous Watershed,
W83-00346 2D

NAKAJIMA, T.
Distribution of Denitrifying Bacteria and its Controlling Factors in Freshwater Environments,
W83-00018 5C

NAYLOR, D. V.
Non-Point Pollution Control for Rangeland Wintering, Livestock Operations (Ground Cover),
W83-00252 5G

NEELY, R. K.
The Effects of Excessive Nitrogen and Phosphorus in Surface Waters of a Prairie Marsh,
W83-00266 5G

NEILSON, G. A.
Soil Maps of Montana,
W83-00237 7C

NEWBRY, B. W.
Water Quality Standards and Water Quality,
W83-00162 5G

NICHOLS, D. S.
Nutrient Removal From Wastewater by Wetlands,
W83-00226 5D

NIEHAUS, M. H.
Conservation Through Crops Research,
W83-00311 3F

NIESSLBECK, P.
Bacterioplankton Affected by Phosphorus Precipitation Treatment in a Polytrophic Lake,
W83-00315 5G

NIXON, S. W.
Anoxic Nutrient Regeneration and the Eutrophication of Estuarine Waters,
W83-00263 5C

NOGRADY, T.
Correlation of Rotifer Associations in a Chain of Lakes Fed by Reclaimed Sewage,
W83-00023 5G

NORRIS, D. P.
High-Quality Trickling Filter Effluent Without Tertiary Treatment,
W83-00142 5D

NURNBERG, H. W.
Differential Pulse Polarography of Some Herbicides Derived From 2,4-Dichlorophenoxyacetic Acid, II. Determination of Herbicide Residues in Irrigation Waters,
W83-00045 5A

O'DONNELL, T. H.
Deep Artesian Aquifers of Sanibel and Captiva Islands, Lee County, Florida,
W83-00114 4B

O'TOOLE, J.
Nitrate Movement and Denitrification Defined Relative to Bromide Tracer in Tile-Drained Land,
W83-00264 5B

ODUM, W. E.
The Ecology of the Mangroves of South Florida: A Community Profile,
W83-00093 6G

OGDEN, J. G. III.
Seasonal Mass Balance of Major Ions in Three Small Watersheds in a Maritime Environment,
W83-00323 2K

OLMSTED, F. H.
The Hydrothermal System in Southern Grass Valley, Pershing County, Nevada,
W83-00060 4B

OLSSON, H.
Characterization of Acid Phosphatases in the Acidified Lake Gardsjon, Sweden,
W83-00050 5C

OMANG, R. J.
Annual Peak Discharges from Small Drainage Areas in Montana Through September 1981,
W83-00071 2E

OMAR, M.
Preconcentration of Environmental Tin and its Determination Using Catechol Violet,
W83-00348 5A

OPDYCKE, J. D.
Development of Chlorine Resistant Membranes, Polyimide Membranes and Porous Substrates,
W83-00246 3A

ORLOB, G. T.
An Alternative to the Peripheral Canal,
W83-00193 6G

ORR, B. R.
Water Resources of the Rincon and Mesilla Valleys and Adjacent Areas, New Mexico,
W83-00078 7C

OSTERKAMP, W. R.
Perennial-Streamflow Characteristics Related to Channel Geometry and Sediment in Missouri River Basin,
W83-00121 4D

OWENS, E. L.
High-Quality Trickling Filter Effluent Without Tertiary Treatment,
W83-00142 5D

PALMER, R. N.
Reservoir Management in Potomac River Basin,
W83-00203 6A

Water Resource System Reliability Under Drought Conditions: The Seattle Water Supply System as a Case Study,
W83-00229 3D

PANWALKAR, S. S.
Incentives for Irrigation Water Conservation in Agriculture,
W83-00278 3F

PARKER, D. S.
High-Quality Trickling Filter Effluent Without Tertiary Treatment,
W83-00142 5D

PARKER, R. S.
Water-Quality Characteristics of Six Small, Semiarid Watersheds in the Green River Coal Region of Colorado,
W83-00124 5A

PARKS, W. S.
Installation and Sampling of Observation Wells and Analyses of Water from the Shallow Aquifer at Selected Waste-Disposal Sites in the Memphis Area, Tennessee,
W83-00066 5B

PARRETT, C.
Annual Peak Discharges from Small Drainage Areas in Montana Through September 1981,
W83-00071 2E

PATNI, N. J.
The Relationship Between Nutrient Status and Chemical Composition of Peridinium Cinctum During the Bloom in Lake Kinneret,
W83-00333 5C

PATRIARCHE, G. J.
Differential Pulse Polarography of Some Herbicides Derived From 2,4-Dichlorophenoxyacetic Acid, II. Determination of Herbicide Residues in Irrigation Waters,
W83-00045 5A

PEARCY, R. W.
Seasonal Progressions in the Water Relations of Deciduous and Evergreen Perennials in the Northern California Chaparral,
W83-00307 2I

PEARSON, W. R.
High Plains - Ogallala Aquifer Study Water Transfer Element,
W83-00312 4A

PENROSE, D. L.
Water Quality in Urban Streams--What we can Expect,
W83-00144 5C

PEREIRA, W. E.
Characterization of Organic Contaminants in Environmental Samples Associated with Mount St. Helens 1980 Volcanic Eruption,
W83-00161 5A

PESSENDA, L. C. R.
Determination of Iron in Natural Waters and Plant Material with 1,10-Phenanthroline by Flow Injection Analysis,
W83-00194 5A

PHILLIPS, C. B.
Estimating Hydrologic Values for Planning Wildland Fire Protection,
W83-00306 6B

PIETERSE, A. J. H.
Algal Concentration and Species Composition in Experimental Maturation Ponds with Effects of Aeration and Recirculation,
W83-00284 5D

PIRBAZARI, M.
Adsorption of Toxic and Carcinogenic Compounds from Water,
W83-00171 5F

PITMAN, W. V.
A Depth-Duration-Frequency Diagram for Point Rainfall in Swa-Namibia,
W83-00289 2B

POSTON, T. M.
Observations on the Bioaccumulation Potential of Thorium and Uranium in Rainbow Trout (Salmo Gairdneri),
W83-00021 5C

POWELL, T. M.
In Situ Response of Phytoplankton Fluorescence to Rapid Variations in Light,
W83-00141 5C

PREPAS, E. E.
Improvements in Quantifying the Phosphorus Concentration in Lake Water,
W83-00208 5C

PRESSER, T. S.
Chemical and Isotopic Composition of Water from Thermal and Mineral Springs of Washington,
W83-00112 2K

PRETORIUS, J.
The Occurrence of a Fungal Parasite on a Tetraselmis (Prasinophyceae) Species,
W83-00288 5C

PROBSTEIN, R. F.
Hydrodynamics and Fouling of Pressure Driven Membrane Desalination and Water Treatment Systems,
W83-00244 3A

PROMNITZ, L. C.
Dendrography for Optimal Water and Energy Utilization in Plant Growth,
W83-00265 3F

PUIJKER, L. M.
Determination of Organophosphorus and Organosulphur at the Sub-NG-Level for Use in Water Analysis,
W83-00046 5A

QASIM, S. R.
Effect of a Bacterial Culture Product on Biological Kinetics,
W83-00212 5D

RAMASAMY, K.
Investigations on Cellulose Biodegradation in Activated Sludge Plants,
W83-00013 5D

RANDTKE, S. J.
New Technology for Drinking Water Treatment,
W83-00198 5F

Removing Soluble Organic Contaminants by Lime-Softening,
W83-00172 5F

RANZAU, C. E. JR.
Approximately Water-Level Changes in Wells in the Chicot and Evangeline Aquifers 1977-82 and 1981-82, and Measured Compaction 1973-82, in the Houston-Galveston Region, Texas,
W83-00075 7C

RAO, P. K.
Policy Objectives and Information System for Irrigation Projects-India,
W83-00011 6A

RASMUSSEN, L. A.
Continuity Equation Model of the Predicted Drastic Retreat of Columbia Glacier, Alaska,
W83-00119 2C

REAVELL, P. E.
The Structure and Some Recent Changes of the Zoobenthic Community in the Ermatinger Becken, A Shallow Littoral Part of Lake Constance,
W83-00036 2H

REES, T. F.
Characterization of Plutonium in Ground Water Near the Idaho Chemical Processing Plant,
W83-00019 5B

REFLING, D. R.
Advanced Biological Treatment to Achieve Nutrient Removal,
W83-00349 5D

RENARD, K. G.
Sediment Yield from Small Semiarid Rangeland Watersheds,
W83-00105 4D

The USLE Rainfall Factor for Southwestern U. S. Rangelands,
W83-00098 4D

REUST, J. B.
Determination of Organic Contaminants in Ultra-Pure Water by Reversed-Phase High-Performance Liquid Chromatography with Ultraviolet Detection,
W83-00202 5A

REVELLE, C. S.
Reservoir Management in Potomac River Basin,
W83-00203 6A

RICHERSON, P. J.
In Situ Response of Phytoplankton Fluorescence to Rapid Variations in Light,
W83-00141 5C

RIEKERK, H.
Pine Tree Evapotranspiration,
W83-00279 2D

RIGGIN, R. M.
Determination of Benzidines in Industrial and Municipal Wastewaters,
W83-00292 5A

ROBERTS, J. W.
Floodflow Characteristics Related to Channel Geometry in Ohio,
W83-00067 2E

ROBERTS, R. T.
Hydrologic Data for Experimental Agricultural Watersheds in the United States, 1973,
W83-00095 7C

ROBINSON, M.
The Use of Oxygen to Uprate the Treatment Capacity of a Conventional Surface-Aeration Plant at Holdenhurst (Bournemouth) Sewage Treatment Works,
W83-00133 5D

ROBINSON, M. J.
The Flow of Slurry from a Breached Tailings Dam,
W83-00285 8B

ROBINSON, R. B.
Rural Water Supply Systems: Improved Planning Strategies Through Systems Analysis,
W83-00241 6A

ROBSON, C. M.
Spreading Lagooned Sewage Sludge on Farmland: A Case History,
W83-00296 5E

ROE, E. M.
Lake Restoration Technology Transfer Assessment,
W83-00215 5G

ROE, P. C. JR.
Adenosine Triphosphate as a Control Parameter for Activated Sludge Processes,
W83-00149 5D

ROMBERG, G. P.
Design of Monitoring Studies for Priority Pollutants,
W83-00321 7A

RONEN, M.
The Characterization and Processing of Lime Sludges from Water Reclamation Plants,
W83-00086 5D

ROQUES, P. F.
Anoxic Nutrient Regeneration and the Eutrophication of Estuarine Waters,
W83-00263 5C

ROSAIN, R. M.
Water Management in the Oil Shale Industry,
W83-00185 5D

ROSSIN, A. C.
The Influence of Process Parameters on the Removal of Heavy Metals in Activated Sludge,
W83-00327 5D

ROSTAD, C. E.
Characterization of Organic Contaminants in Environmental Samples Associated with Mount St. Helens 1980 Volcanic Eruption,
W83-00161 5A

ROYBAL, R. G.
Water Resources of the Rincon and Mesilla Valleys and Adjacent Areas, New Mexico,
W83-00078 7C

ROZANSKI, K.
Factors Controlling Stable Isotope Composition of European Precipitation,
W83-00176 2B

RUHL, J. F.
Designation of Principal Water-Supply Aquifers in Minnesota,
W83-00125 2F

RUNKEL, K. H.
Investigations on the Lakes of Peru and Their Phytoplankton. 6 Additional Chemical Analyses,
W83-00037 2H

SAHA, S. K.
Irrigation Planning in the Tana Basin of Kenya,
W83-00015 6B

SAIJO, Y.
Nitrogen Metabolism in Lake Kizaki, Japan I. Ammonium and Nitrate Uptake by Phytoplankton,
W83-00344 2H

Nitrogen Metabolism in Lake Kizaki, Japan II. Distribution and Decomposition of Organic Nitrogen,
W83-00345 2H

Nitrogen Metabolism in Lake Kizaki, Japan. III. Active Nitrification in Early Summer,
W83-00040 2H

SAMMIS, E. J.
Water-Use Production Functions of Selected Agronomic Crops in Northwestern New Mexico, Phase I,
W83-00235 3F

SAULNIER, G. J. JR.
Use of Mathematical Models to Predict Impacts of Mining Energy Minerals on the Hydrologic System in Northwestern Colorado,
W83-00168 4C

SAWHNEY, B. L.
Multiple Purge Techniques for Determining Organic Pollutants in Groundwater,
W83-00158 5A

SCHANZ, F.
Limnological Investigations of a Mountain Spring Pond in the Swiss National Park,
W83-00034 2H

SCHILLINGER, J. E.
Coliform Attachment to Suspended Particles in Stormwater,
W83-00224 5B

SCHOPP, R. D.
Low-Flow Characteristics and Flow Duration of New Jersey Streams,
W83-00061 7C

SCHULZ, R. S.
Rural Water Supply Systems: Improved Planning Strategies Through Systems Analysis,
W83-00241 6A

SCHULZE, R. E.
Hydrology and Water Resources of the Drakensberg,
W83-00085 4A

The Spatial Distribution in Southern Africa of Rainfall Erosivity for Use in the Universal Soil Loss Equation,
W83-00140 2J

SCHWAB, B. S.
Mineralization of Linear Alcohol Ethoxylates and Linear Alcohol Ethoxy Sulfates at Trace Concentrations in Estuarine Water,
W83-00211 5B

SCOTT, A. G.
Investigation of Trends in Flooding in the Tug Fork Basin of Kentucky, Virginia, and West Virginia,
W83-00128 4A

SEPERS, A. B. J.
The Aerobic Mineralization of Amino Acids in the Saline Lake Grevelingen and the Freshwater Haringvliet Basin (The Netherlands),
W83-00178 5C

SHARPE, W. E.
Hazardous Waste Technology Transfer Assessment,
W83-00276 5E

Lake Restoration Technology Transfer Assessment,
W83-00215 5G

The Laurel Run Acid Mine Drainage Renovation Demonstration Facility: An Evaluation,
W83-00258 5G

SHAW, R. H.
Efficient Use of Water for Irrigation in the Upper Midwest,
W83-00242 3F

SHELTON, W. L.
Production of Reproductively Limited Grass Carp for Biological Control of Aquatic Weeds - Phase II,
W83-00272 4A

SHEN, T. C.
Development of Novel Porous Substrates for Ultrafiltration, Desalination and Water Reclamation--Part III,
W83-00259 3A

SHERIDAN, R. P.
Municipal Pretreatment Program Development,
W83-00350 5D

SHERWIN, L. S.
The Laurel Run Acid Mine Drainage Renovation Demonstration Facility: An Evaluation,
W83-00258 5G

SHILLINGLAW, S. N.
Algal Concentration and Species Composition in Experimental Maturation Ponds with Effects of Aeration and Recirculation,
W83-00284 5D

SHIRLEY, E. D.
Modeling Erosion in Overland Flow,
W83-00104 4D

SIKONIA, W. G.
Finite Element Glacier Dynamics Model Applied to Columbia Glacier, Alaska,
W83-00118 2C

SILSBEE, D. G.
Water Quality of Streams in the Great Smoky Mountains National Park,
W83-00032 5B

SIMANTON, J. R.
The USLE Rainfall Factor for Southwestern U. S. Rangelands,
W83-00098 4D

SIMMLER, J. J.
Municipal Pretreatment Program Development,
W83-00350 5D

SIMMONS, M. S.
Association Studies of Polybrominated Biphenyls in Aquatic Systems,
W83-00160 5B

SINGLEY, M. E.
Land Application of Municipal Sludge with Regard to Cropping Systems and Pollution Potential,
W83-00233 5E

SINNOTT, A.
Summary Appraisals of the Nation's Ground-Water Resources--New England Region,
W83-00120 4B

SLACK, J. R.
A Study of Trends in Total Phosphorus Measurements at Nasqan Stations,
W83-00126 5B

SLAGLE, S. E.
Geohydrology of Southwestern Kansas,
W83-00059 7C

SLAPIK, M. A.
Improvements in Foam Flotation for Lead Removal,
W83-00150 5D

SMITH, E. D.
Water Characteristics,
W83-00169 5B

SMITH, J. A.
Reservoir Management in Potomac River Basin,
W83-00203 6A

SMITH, R. A.
A Study of Trends in Total Phosphorus Measurements at Nasqan Stations,
W83-00126 5B

SMITH, T. J. III.
The Ecology of the Mangroves of South Florida: A Community Profile,
W83-00093 6G

SMITHEN, A. A.
The Spatial Distribution in Southern Africa of Rainfall Erosivity for Use in the Universal Soil Loss Equation,
W83-00140 2J

SMOCK, L. A.
Littoral and Profundal Macroinvertebrate Communities of a Coastal Brown-Water Lake,
W83-00044 2H

SMOL, J. P.
The Recent Histories of Three Canadian Shield Lakes: A Paleolimnological Experiment,
W83-00042 5C

SOMMERS, L. E.
Spreading Lagooned Sewage Sludge on Farmland: A Case History,
W83-00296 5E

SONNTAG, C.
Factors Controlling Stable Isotope Composition of European Precipitation,
W83-00176 2B

SOREY, M. L.
The Hydrothermal System in Southern Grass Valley, Pershing County, Nevada,
W83-00060 4B

SORTLAND, B.
Polycyclic Aromatic Hydrocarbons in Sewage, Mussels and Tap Water,
W83-00330 5B

SPANGLER, L. E.
Groundwater in the Inner Bluegrass Karst Region, Kentucky,
W83-00275 2F

STEGGALL, J. W.
Reevaluation of the Effects of Deicing Salt Runoff on a Small Urban Lake,
W83-00227 5C

STEINBERG, C.
Bacterioplankton Affected by Phosphorus Precipitation Treatment in a Polytrophic Lake,
W83-00315 5G

STELZ, W. G.
Geohydrology of the Valley-Fill Aquifer in the South Fallsburgh-Woodbourne Area, Sullivan County, New York,
W83-00069 7C

STENSEL, H. D.
Advanced Biological Treatment to Achieve Nutrient Removal,
W83-00349 5D

STEPHENSON, G. R.
Non-Point Pollution Control for Rangeland Wintering, Livestock Operations (Ground Cover),
W83-00252 5G

STERRITT, R. M.
The Influence of Process Parameters on the Removal of Heavy Metals in Activated Sludge,
W83-00327 5D

STEWART, A. J.
Phytoplankton Contribution to Alkaline Phosphatase Activity,
W83-00041 2H

STINEHELFER, M. L.
Effect of a Bacterial Culture Product on Biological Kinetics,
W83-00212 5D

STOLTENBERG, D.
Digester Control Pays Dividends,
W83-00192 5D

STONE, J. J.
Sediment Yield from Small Semiarid Rangeland Watersheds,
W83-00105 4D

STONEBURNER, D. L.
Littoral and Profundal Macroinvertebrate Communities of a Coastal Brown-Water Lake,
W83-00044 2H

STOREY, D. A.
Lump Sum Tax Loss Reimbursement Under the Thames River Flood Control Compact,
W83-00005 6B

STRAUSE, J. L.
Approximately Water-Level Changes in Wells in the Chicot and Evangeline Aquifers 1977-82 and 1981-82, and Measured Compaction 1973-82, in the Houston-Galveston Region, Texas,
W83-00075 7C

SULLIVAN, C. Y.
Variability in Crop Physiological and Morphological Characteristics Controlling Water Use Efficiency and Grain Yield,
W83-00234 3F

SWAN, M. J.
Improvement in Coal Preparation-Water Clarification Through Polymer Flocculation,
W83-00177 5D

SWEENEY, J. J.
Trade Effluent Control and the Microprocessor,
W83-00003 5G

SZEKELY, F.
Environmental Impact of Large Hydroelectric Projects on Tropical Countries,
W83-00010 6G

TAKAHASHI, M.
Nitrogen Metabolism in Lake Kizaki, Japan I. Ammonium and Nitrate Uptake by Phytoplankton,
W83-00344 2H

Nitrogen Metabolism in Lake Kizaki, Japan II. Distribution and Decomposition of Organic Nitrogen,
W83-00345 2H

Nitrogen Metabolism in Lake Kizaki, Japan. III. Active Nitrification in Early Summer,
W83-00040 2H

TALLING, J. F.
The Development of Attenuance Depth-Profiling to Follow the Changing Distribution of Phytoplankton and Other Particulate Material in a Productive English Lake,
W83-00055 5C

TAYLOR, H. E.
Characterization of Organic Contaminants in Environmental Samples Associated with Mount St. Helens 1980 Volcanic Eruption,
W83-00161 5A

TAYLOR, M. C.
Guidelines for Surface Water Quality: Vol 1: Inorganic Chemical Substances: Copper,
W83-00079 5G

TEKIPPE, R. J.
Water Quality Criteria and Effluent Requirements in Broward County, Florida,
W83-00320 5G

THACKSTON, E. L.
Improvements in Foam Flotation for Lead Removal,
W83-00150 5D

THIEL, C. E.
Removing Soluble Organic Contaminants by Lime-Softening,
W83-00172 5F

THOMAS, C. P.
Tracing Well Water Pollution in a Limestone Aquifer,
W83-00173 5B

THOMAS, N. O.
Manual for Leveling at Gaging Stations in North Carolina,
W83-00065 7B

THOMPSON, J. C.
New EPA Sodium and Corrosion Regulations: Their Basis and Impacts,
W83-00137 5G

THORNTON, J. A.
Applicability of Phosphorus Budget Models to Southern African Man-Made Lakes,
W83-00025 5C

THORPE, J. W.
Comparison of Sulfide-Selective Electrode and Gas-Stripping Monitors for Hydrogen Sulfide in Effluents,
W83-00204 5A

THORSON, N. W.
Analysis of Legal and Institutional Arrangements Affecting Water Allocation and Use in Nebraska,
W83-00250 6E

THRAILKILL, J.
Groundwater in the Inner Bluegrass Karst Region, Kentucky,
W83-00275 2F

THURMAN, J. L.
Hydrologic Data for Experimental Agricultural Watersheds in the United States, 1973,
W83-00095 7C

THYSSEN, N.
Storage of Carbon and Transport of Oxygen in River Macrophytes: Mass-Balance, and the Measurement of Primary Productivity in Rivers,
W83-00051 5B

TITAMNIS, Z. V.
Daily Chemical Variability of Domestic Septic Tank Effluent,
W83-00328 5D

TITTLEBAUM, M. E.
Algae Removal by Induced Air Flotation,
W83-00277 5G

TOERIEN, D. F.
Preliminary Studies on the Treatment of Canning Factory Effluent with an Integrated Bacterial-Algal-Fish System,
W83-00317 5D

Stabilizing High-Strength Wastes with Photosynthetic Bacteria,
W83-00181 5D

TOMASCHKE, J. E.
Development of Chlorine Resistant Membranes, Polyimide Membranes and Porous Substrates,
W83-00246 3A

TORAK, L. J.
Applications of Digital Modeling for Evaluating the Ground-Water Resources of the '2,000-Foot' Sand of the Baton Rouge Area, Louisiana,
W83-00109 4B

TORRES-GONZALEZ, A.
Geohydrologic Descriptions of Selected Solid-Waste Disposal Sites,
W83-00072 5B

TOTH, S. J.
Land Application of Municipal Sludge with Regard to Cropping Systems and Pollution Potential,
W83-00233 5E

TOWNLEY, J. M.
Ho: For Reese River Natural Resources of the Toiyabe-Toquima Highlands, Central Nevada,
W83-00253 6B

TREWEEK, G. P.
Water Quality Criteria and Effluent Requirements in Broward County, Florida,
W83-00320 5G

TROESTER, J. W.
Groundwater in the Inner Bluegrass Karst Region, Kentucky,
W83-00275 2F

TUNTOOLAVEST, M.
Effect of Activated Sludge Operational Conditions on Sludge Thickening Characteristics,
W83-00179 5D

TURK, J. T.
Water-Quality Characteristics of Six Small, Semiarid Watersheds in the Green River Coal Region of Colorado,
W83-00124 5A

TWORECK, W. C.
Solid Waste Management in South Africa,
W83-00090 5G

UHL, V. W. JR.
Control Measures for Groundwater VOCS,
W83-00199 5F

VALENTA, P.
Differential Pulse Polarography of Some Herbicides Derived From 2,4-Dichlorophenoxyacetic Acid, II. Determination of Herbicide Residues in Irrigation Waters,
W83-00045 5A

VAN DER GEUGTEN, R. P.
Determination of Boron in River Water with Flameless Atomic Absorption Spectrometry (Graphite Furnace Technique),
W83-00047 5A

VAN WYK, D. B.
Influence of Prescribed Burning on Nutrient Budgets of Mountain Fynbos Catchments in the S. W. Cape, Rep. of South Africa,
W83-00304 5B

VANAGEL, M. A.
The Laurel Run Acid Mine Drainage Renovation Demonstration Facility: An Evaluation,
W83-00258 5G

VARLEY, R. A.
The Use of Oxygen to Uprate the Treatment Capacity of a Conventional Surface-Aeration Plant at Holdenhurst (Bournemouth) Sewage Treatment Works,
W83-00133 5D

VASHON, R. D.
Mineralization of Linear Alcohol Ethoxylates and Linear Alcohol Ethoxy Sulfates at Trace Concentrations in Estuarine Water,
W83-00211 5B

VAUGHN, C. C.
Distribution of Chironomids in the Littoral Zone of Lake Texoma, Oklahoma and Texas,
W83-00031 2H

VEENENDAAL, G.
Determination of Organophosphorus and Organosulphur at the Sub-NG-Level for Use in Water Analysis,
W83-00046 5A

VERACHTERT, H.
Investigations on Cellulose Biodegradation in Activated Sludge Plants,
W83-00013 5D

VERDONSCHOT, P. F. M.
Some Notes on the Ecology of Aquatic Oligochaetes in the Delta Region of the Netherlands,
W83-00035 2L

VERDUN, J.
Components Contributing to Light Extinction in Natural Water: Method of Isolation,
W83-00213 5A

VERRIOPOULOS, G.
Impact of Chromium to the Population Dynamics of Tisbe Holothuriae,
W83-00043 5C

VIGERS, G. A.
Design of Monitoring Studies for Priority Pollutants,
W83-00321 7A

VIRTANEN, M. T.
The Fate of 2,4,6-Trichlorophenol in an Aquatic Continuous-Flow System,
W83-00332 5B

WAGSTAFF, K.
Pre-Concentration Technique for Cold-Vapour Atomic-Fluorescence Determination of Mercury in Drinking Waters,
W83-00195 5A

WALKER, O. L.
Recycling of Mercury and Silver from COD Tests,
W83-00145 5D

WALKER, W. R.
Law,
W83-00165 6E

WALMSLEY, R. D.
Applicability of Phosphorus Budget Models to Southern African Man-Made Lakes,
W83-00025 5C

WALTI, K.
Limnological Investigations of a Mountain Spring Pond in the Swiss National Park,
W83-00034 2H

WARNICK, C. C.
Assessment of the Usefulness of Hydrologic Data for Hydropower Feasibility Analysis,
W83-00251 2E

WATT, M. H.
A Curriculum for Water Supply and Wastewater Operation, Maintenance and Management,
W83-00247 5G

WATTS, J. A.
Transport of Organic Carbon to the Oceans by Rivers of North America: A Synthesis of Existing Data,
W83-00174 5B

WAUTHY, G.
Some Aspects of the Colonization by Water Mites (Acari, Actinedida) of an Artifical Substrate in a Disturbed Environment,
W83-00054 5C

WAYBRANT, R. C.
Effects of Michigan's Phosphorus Detergent Ban on Municipal Chemical Costs,
W83-00147 5G

WEBBER, E. E.
Floodflow Characteristics Related to Channel Geometry in Ohio,
W83-00067 2E

WEBER, W. J. JR.
Adsorption of Toxic and Carcinogenic Compounds from Water,
W83-00171 5F

WEIBEZAHN, F.
The Chemistry and Phytoplankton of the Orinoco and Caroni Rivers, Venezuela,
W83-00187 5B

WEINTRAUB, M.
Biooxidation of Paint Process Wastewater,
W83-00143 5D

WELCH, A. H.
The Hydrothermal System in Southern Grass Valley, Pershing County, Nevada,
W83-00060 4B

WELLS, W. G. II
Role of Fungi in Postfire Stabilization of Chaparral Ash Beds,
W83-00302 4D

WENTZEL, R. S.
Increasing Arcat Test Sensitivity for Examination of Potable Waters,
W83-00293 5F

WESCHE, T. A.
Instream Salmonid Habitat Exclusion by Ice-Cover,
W83-00257 8I

WEST, P. A.
The Incidence of Vibrio Cholerae in Water, Animals and Birds in Kent, England,
W83-00012 5B

WESTERBACK, A. E.
Cathodic Protection of Water Mains,
W83-00175 8G

WESTERHOFF, G. P.
Control Measures for Groundwater VOCS,
W83-00199 5F

WETZEL, R. G.
Phytoplankton Contribution to Alkaline Phosphatase Activity,
W83-00041 2H

WHALEN, S. C.
Physicochemical Limnology of the Tongue River Reservoir, Montana,
W83-00033 2H

WHEELER, J. C.
Map Showing the Potentiometric Surface of the Magothy Aquifer in Southern Maryland, September 1981,
W83-00115 7C

WHELAN, B. R.
Daily Chemical Variability of Domestic Septic Tank Effluent,
W83-00328 5D

WHELAN, G.
IIHR Distrubuted Parameter Watershed Model,
W83-00269 2E

WHITE, R. R.
Water Resources of the Rincon and Mesilla Valleys and Adjacent Areas, New Mexico,
W83-00078 7C

WHITEHEAD, P. G.
Practical Techniques of River Monitoring and Pollution Forecasting,
W83-00238 5B

WHITEMAN, C. D. JR.
Applications of Digital Modeling for Evaluating the Ground-Water Resources of the '2,000-Foot' Sand of the Baton Rouge Area, Louisiana,
W83-00109 4B

WICHERS, D. L.
Instream Salmonid Habitat Exclusion by Ice-Cover,
W83-00257 8I

WILLIAMS, J. R.
Testing the Modified Universal Soil Loss Equation,
W83-00107 4D

WILSON, C. A.
Water Resources of the Rincon and Mesilla Valleys and Adjacent Areas, New Mexico,
W83-00078 7C

WILSON, D. B.
Water Treatment for Small Public Supplies,
W83-00280 5F

WILSON, D. J.
Improvements in Foam Flotation for Lead Removal,
W83-00150 5D

WILSON, W. E.
Estimated Effects of Projected Ground-Water With-Drawals on Movement of the Saltwater Front in the Floridan Aquifer, 1976-2000, West-Central Florida,
W83-00130 4B

WINTER, S. J.
Assessment of Low Head, Micro Hydroelectric Equipment for Use on Small Tropical Islands,
W83-00268 8C

WISNIEWSKI, J.
An Overview of Acid Rain Monitoring Activities in North America,
W83-00189 5C

WITT, V. M.
Developing and Applying International Water Quality Guidelines,
W83-00167 5G

WOHLGEMUTH, P. M.
Role of Fungi in Postfire Stabilization of Chaparral Ash Beds,
W83-00302 4D

WOLF, R. J.
Designation of Principal Water-Supply Aquifers in Minnesota,
W83-00125 2F

WOOD, WAYNE A.
Selected Hydrogeologic Data from Southern Sweet Grass County, South-Central Montana,
W83-00076 7C

WRIGHT, J. C.
Physicochemical Limnology of the Tongue River Reservoir, Montana,
W83-00033 2H

WRIGHT, V. A.
Methods for Collection and Analysis of Geopressured Geothermal and Oil Field Waters,
W83-00127 2K

WYANT, T.
Investigation of Trends in Flooding in the Tug Fork Basin of Kentucky, Virginia, and West Virginia,
W83-00128 4A

WYNNE, D.
The Relationship Between Nutrient Status and Chemical Composition of Peridinium Cinctum During the Bloom in Lake Kinneret,
W83-00333 5C

YAMAYA, C. N.
Removing Soluble Organic Contaminants by Lime-Softening,
W83-00172 5F

YASUDA, H.
A Study of Glow Discharge Polymerization as a Means of Preparing Composite Reverse Osmosis Membranes with Ultrathin Skin,
W83-00260 3A

YOSHIOKA, T.
Nitrogen Metabolism in Lake Kizaki, Japan. III. Active Nitrification in Early Summer,
W83-00040 2H

YOUNG, D. D.
Chemical Surveillance of Rivers,
W83-00134 5A

YOUNG, G. P.
Water Quality Simulation of Wahiawa Reservoir, O'Ahu, Hawaii,
W83-00281 5G

YOUNG, R. H. F.
Water Quality Simulation of Wahiawa Reservoir, O'Ahu, Hawaii,
W83-00281 5G

ZAGATTO, E. A. G.
Determination of Iron in Natural Waters and Plant Material with 1,10-Phenanthroline by Flow Injection Analysis,
W83-00194 5A

ZAISS, U.
The Sediments of the New Artificial Lake Bostalsee (Saarland, Germany), with Particular Reference to Microbial Activity,
W83-00048 5C

ZASUKHIN, V. S.
Use of the Water-Salt Balance Method for Calculating the Desalination Regime of a Large Water Body,
W83-00322 5G

ZASUKHINA, E. S.
Use of the Water-Salt Balance Method for Calculating the Desalination Regime of a Large Water Body,
W83-00322 5G

ZIMNY, B. L.
Development of Novel Porous Substrates for Ultrafiltration, Desalination and Water Reclamation--Part III,
W83-00259 3A

ZOLAN, W. J.
A Preliminary Study of Natural Aquifer Discharge of Guam,
W83-00271 5B

ORGANIZATIONAL INDEX

AGRICULTURAL RESEARCH CENTER, BELTSVILLE, MD. HYDROLOGIC DATA LAB.
Hydrologic Data for Experimental Agricultural Watersheds in the United States, 1973,
W83-00095 7C

AGRICULTURAL RESEARCH SERVICE, BELTSVILLE, MD. HYDROLOGY LAB.
Rainfall-Runoff Characteristics for a Mountainous Watershed in the Northeast United States,
W83-00347 2A

AGRICULTURAL RESEARCH SERVICE, TEMPLE, TX.
Testing the Modified Universal Soil Loss Equation,
W83-00107 4D

ALASKA UNIV., FAIRBANKS. INST. OF MARINE SCIENCE.
Physicochemical Limnology of the Tongue River Reservoir, Montana,
W83-00033 2H

ALBERTA ENVIRONMENTAL CENTER, VEGREVILLE.
Determination of Pyrazon Residues in Water by Reversed Phase High Performance Liquid Chromatography,
W83-00014 5A

Seasonal Abundance of Ceratium Hirundinella, (O.F. Muller) Schrank in Lakes of Different Trophy,
W83-00052 5C

ALBERTA RESEARCH COUNCIL, EDMONTON. GEOLOGY DIV.
Geologic Criteria in Waste-Management Site Selection in Northeastern North Dakota,
W83-00236 5E

ALBERTA UNIV., EDMONTON. DEPT. OF BOTANY.
Paleolimnology of Lake Isle, Alberta, Canada (Including Sediment Chemistry, Pigments and Diatom Stratigraphy),
W83-00316 2H

ALBERTA UNIV., EDMONTON. DEPT. OF CIVIL ENGINEERING.
Water Reclamation and Reuse,
W83-00163 5D

ALBERTA UNIV., EDMONTON. DEPT. OF ZOOLOGY.
Improvements in Quantifying the Phosphorus Concentration in Lake Water,
W83-00208 5C

ANDERSON-NICHOLS AND CO., INC., BOSTON, MA.
Design and Construction of the Pennichuck Water Treatment Plant: The Engineer's View,
W83-00135 5F

ANGLIAN WATER AUTHORITY (ENGLAND). LINCOLN SEWAGE DIV.
Trade Effluent Control and the Microprocessor,
W83-00003 5G

ANTWERP UNIV., WILRIJK (BELGIUM).
Dissolved Organic Carbon and UV-Absorption in a Polluted Lowland Brook-Pond System,
W83-00024 5G

ARIZONA STATE UNIV., TEMPE. DIV. OF AGRICULTURE NATURAL RESOURCE MANAGEMENT.
Runoff and Sedimentation Potentials Influenced by Litter and Slope on a Chaparral Community in Central Arizona,
W83-00301 4D

ARIZONA UNIV. TUCSON. DEPT. OF HYDROLOGY AND WATER RESOURCES.
The Role of Hydrologic Variability in Complying with Regulatory Enforcement Standards for the Rehabilitation of Surface-Mined Coal Lands,
W83-00223 6G

ARIZONA UNIV., TUCSON. OFFICE OF ARID LANDS STUDIES.
Application of Remote Sensing in Evaluating Floodwater Farming on the Papago Indian Reservation,
W83-00230 3F

ARMY ENGINEER DISTRICT, PORTLAND, OR.
Existence of Phytoplankton in Spirit Lake Near Active Volcano Mt. St. Helens, Washington, U.S.A.: Post-Eruption Findings,
W83-00026 5C

ARMY ENGINEER WATERWAYS EXPERIMENT STATION, VICKSBURG, MS. ENVIRONMENTAL LAB.
Control of Lake Phosphorus with Aluminum Sulfate: Dose Determination and Application Techniques,
W83-00006 5C

ATHENS UNIV. (GREECE). ZOOLOGICAL LAB. AND MUSEUM.
Impact of Chromium to the Population Dynamics of Tisbe Holothuriae,
W83-00043 5C

ATLANTIC RESEARCH CORP., ALEXANDRIA, VA.
Increasing Arcat Test Sensitivity for Examination of Potable Waters,
W83-00293 5F

ATOMIC ENERGY OF CANADA LTD. CHALK RIVER (ONTARIO). CHALK RIVER NUCLEAR LAB.
Comparison of Sulfide-Selective Electrode and Gas-Stripping Monitors for Hydrogen Sulfide in Effluents,
W83-00204 5A

AUBURN UNIV., AL. DEPT. OF FISHERIES AND ALLIED AQUACULTURES.
Production of Reproductively Limited Grass Carp for Biological Control of Aquatic Weeds - Phase II,
W83-00272 4A

BATTELLE COLUMBUS LAB., OH.
Development of New Chemical Additives and Treatments for Scale Control in Saline Water Evaporators,
W83-00222 3A

BATTELLE COLUMBUS LABS., OH.
Determination of Benzidines in Industrial and Municipal Wastewaters,
W83-00292 5A

BAYERISCHES LANDESAMT FUER WASSERWIRTSCHAFT, MUNCHEN (GERMANY, F.R.).
Bacterioplankton Affected by Phosphorus Precipitation Treatment in a Polytrophic Lake,
W83-00315 5G

BEND RESEARCH, INC., OR.
Development of Composite Hollow Fibers - Phase III,
W83-00267 3A

BERNE UNIV. (SWITZERLAND). INST. FOR INORGANIC, ANALYTICAL AND PHYSICAL CHEMISTRY.
Determination of Organic Contaminants in Ultra-Pure Water by Reversed-Phase High-Performance Liquid Chromatography with Ultraviolet Detection,
W83-00202 5A

BROWN AND CALDWELL, EUGENE, OR.
High-Quality Trickling Filter Effluent Without Tertiary Treatment,
W83-00142 5D

BROWN AND CALDWELL, PASADENA, CA.
Case Study Analyses of 208 Program Effectiveness in Improving Regional Water Resources Management,
W83-00240 6B

BROWN AND CALDWELL, WALNUT CREEK, CA.
Municipal Pretreatment Program Development,
W83-00350 5D

BUNDESGESUNDHEITSAMT, NEUHERBERG (GERMANY, F.R.). INST. FUER STRAHLENI HYGIENE.
Excretion and DOC Utilization by Oscillatoria Rubescens D.C. and its Accompanying Micro-Organisms,
W83-00183 5C

BUREAU OF LAND MANAGEMENT, BOISE, ID.
Use of Erosion Models on Western Rangelands,
W83-00097 2J

BUREAU OF LAND MANAGEMENT, VERNAL, UT.
Final Environmental Impact Statement of the White River Dam Project.
W83-00297 6G

BUREAU OF MINES, PITTSBURGH, PA. PITTSBURGH RESEARCH CENTER.
Sludge Disposal from Acid Mine Drainage Treatment,
W83-00298 5E

BUREAU OF RECLAMATION, DENVER, CO. ENGINEERING AND RESEARCH CENTER.
Plumbline Monitor Interface,
W83-00094 8G

BUREAU OF RECLAMATION, DENVER, CO. ENGINEERING RESEARCH CENTER.
Mass Balance Model Estimation of Phosphorus Concentrations in Reservoirs,
W83-00009 5C

CALIFORNIA STATE UNIV., NORTHRIDGE. DEPT. OF GEOGRAPHY.
Erosion and Sedimentation as Part of the Natural System,
W83-00305 2J

CALIFORNIA UNIV., DAVIS. DEPT. OF BOTANY.
Seasonal Progressions in the Water Relations of Deciduous and Evergreen Perennials in the Northern California Chaparral,
W83-00307 2I

CALIFORNIA UNIV., DAVIS. DEPT. OF CIVIL ENGINEERING.
An Alternative to the Peripheral Canal,
W83-00193 6G

CAMP, DRESSER, AND MCKEE, INC., BOSTON, MA.
New EPA Sodium and Corrosion Regulations: Their Basis and Impacts,
W83-00137 5G

CANADA CENTRE FRO INLAND WATERS, BURLINGTON (ONTARIO).
Adaptation of the ILLUDAS Model to a Desktop Computer,
W83-00081 7B

CAPE TOWN UNIV. (SOUTH AFRICA). DEPT. OF CHEMICAL ENGINEERING.
A Simulation Study on the Operation of Laboratory Scale Anaerobic Digesters,
W83-00138 5D

CENTER FOR DEVELOPMENT RESEARCH, HYDERABAD (INDIA).

CENTER FOR DEVELOPMENT RESEARCH, HYDERABAD (INDIA).
Policy Objectives and Information System for Irrigation Projects-India,
W83-00011 6A

CENTER FOR ENVIRONMENTAL STUDIES, LEIDEN (NETHERLANDS).
Phosphate and Wind in a Shallow Lake,
W83-00184 5B

CENTRAL INST. FOR INDUSTRIAL RESEARCH, OSLO (NORWAY).
Polycyclic Aromatic Hydrocarbons in Sewage, Mussels and Tap Water,
W83-00330 5B

CENTRO DI ENERGIA NUCLEAR NA AGRICULTURA, SAO PAULO (BRAZIL).
Determination of Iron in Natural Waters and Plant Material with 1,10-Phenanthroline by Flow Injection Analysis,
W83-00194 5A

CH2M/HILL, BELLEVUE, WA.
Water Management in the Oil Shale Industry,
W83-00185 5D

CHALMERS UNIV. OF TECHNOLOGY, GOETEBORG (SWEDEN). INSTITUTIONEN FOER VATTENBYGANAD.
Estimating Runoff Volumes from Urban Areas,
W83-00007 4A

CHULALONGKORN UNIV., BANGKOK (THAILAND). DEPT. OF SANITARY ENGINEERING.
Effect of Activated Sludge Operational Conditions on Sludge Thickening Characteristics,
W83-00179 5D

CINCINNATI UNIV., OH. DEPT. OF MECHANICAL ENGINEERING.
Determination of Benzidines by Gas Chromatographic Separation of Derivatives with Electron Capture Detection,
W83-00182 5A

CITY ENGINEERING DEPT., CAPE TOWN, SOUTH AFRICA.
Blackheath Water Treatment Plant,
W83-00283 5F

CLARKSON COLL. OF TECHNOLOGY, POTSDAM, NY. DEPT. OF CIVIL AND ENVIRONMENTAL ENGINEERING.
An Evaluation of the Recovery of Adirondack Acid Lakes by Chemical Manipulation,
W83-00245 5G

CLEMSON UNIV., SC. DEPT. OF MICROBIOLOGY.
Aerobic Degradation of Diuron by Aquatic Microorganisms,
W83-00002 5B

COLORADO STATE UNIV., FORT COLLINS. DEPT. OF CIVIL ENGINEERING.
Water Quality Standards and Water Quality,
W83-00162 5G

COLORADO UNIV., BOULDER. DEPT. OF ENVIRONMENTAL, POPULATION AND ORGANISMIC.
The Chemistry and Phytoplankton of the Orinoco and Caroni Rivers, Venezuela,
W83-00187 5B

COLUMBIA NATIONAL FISHERY RESEARCH LAB., MD.
Acidic Precipitation and Its Consequences for Aquatic Ecosystems: A Review,
W83-00331 5C

COMMONWEALTH SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANIZATION, WEMBLEY (AUSTRALIA). DIV. OF LAND RESOURCES MANAGEMENT.
Daily Chemical Variability of Domestic Septic Tank Effluent,
W83-00328 5D

COMPAGNIE GENERALE DES EAUX, PARIS (FRANCE).
A New Method of Leak Detection in Distribution Systems Under Pressure: Acoustic Correlation,
W83-00205 8G

CONCORDIA UNIV., MONTREAL (QUEBEC).
Correlation of Rotifer Associations in a Chain of Lakes Fed by Reclaimed Sewage,
W83-00023 5G

CONNECTICUT AGRICULTURAL EXPERIMENT STATION, NEW HAVEN.
Multiple Purge Techniques for Determining Organic Pollutants in Groundwater,
W83-00158 5A

CONNECTICUT UNIV., STORRS. DEPT. OF CIVIL ENGINEERING.
Heavy Metal Interactions and Dynamics in Simulated Naugatuck River Microcosms,
W83-00214 5B

CONNECTICUT UNIV., STORRS. INST. OF WATER RESOURCES.
Hazardous Pollutant Analysis in Water Using Infrared Spectroscopy,
W83-00231 5A

CONSTRUCTION ENGINEERING RESEARCH LAB. (ARMY), CHAMPAIGN, IL.
Water Characteristics,
W83-00169 5B

CORPS OF ENGINEERS, DALLAS, TX. SOUTHWESTERN DIV.
High Plains - Ogallala Aquifer Study Water Transfer Element,
W83-00312 4A

DALHOUSIE UNIV., HALIFAX. DEPT. OF BIOLOGY.
Seasonal Mass Balance of Major Ions in Three Small Watersheds in a Maritime Environment,
W83-00323 2K

DAYTON UNIV., OH. DEPT. OF MICROBIOLOGY.
Microorganisms Capable of Degrading Refractory Hydrocarbons in Ohio Waters,
W83-00219 5B

DELAWARE UNIV., NEWARK. WATER RESOURCES CENTER.
Cause of Inefficient Solids Separation in the Activated Sludge Process,
W83-00232 5D

DELTA INST. FOR HYDROBIOLOGICAL RESEARCH, YERSEKE (NETHERLANDS).
The Aerobic Mineralization of Amino Acids in the Saline Lake Grevelingen and the Freshwater Haringvliet Basin (The Netherlands),
W83-00178 5C

DEPARTMENT OF AGRICULTURE AND FISHERIES, PIETERMARITZBURG (SOUTH AFRICA).
The Spatial Distribution in Southern Africa of Rainfall Erosivity for Use in the Universal Soil Loss Equation,
W83-00140 2J

DEPARTMENT OF SCIENTIFIC AND INDUSTRIAL RESEARCH, TAUPO (NEW ZEALAND). FRESHWATER SECTION.
An Integrated Study on Littoral and Pelagic Primary Production in a Southern African Coastal Lake,
W83-00053 5C

DEPARTMENT OF THE ENVIRONMENT, OTTAWA (ONTARIO).
Textile Industry Wastewater Treatment by Air Flotation,
W83-00080 5D

DEPARTMENT OF THE ENVIRONMENT, OTTAWA (ONTARIO). INLAND WATERS DIRECTORITE.
Guidelines for Surface Water Quality: Vol 1: Inorganic Chemical Substances: Copper,
W83-00079 5G

DEPARTMENT OF WATER AFFAIRS, PRETORIA (SOUTH AFRICA). DIV. OF HYDROLOGY.
The Analyses of Areal Rainfall Using Multi-Quadric Surfaces,
W83-00088 2B

The Statistics of Extreme Values and the Analyses of Floods in South Africa,
W83-00089 2E

DEPARTMENT OF WATER AFFAIRS, PRETORIA (SOUTH AFRICA); HYDROLOGICAL RESEARCH INST., PRETORIA (SOUTH AFRICA).
The Toxicology of Silver Iodide in Relation to its use as a Cloud Seeding Agent,
W83-00084 2B

Soil Survey of the Experimental Catchments Near Bethlehem,
W83-00087 4D

DISTRICT OF COLUMBIA UNIV., WASHINGTON. WATER RESOURCES RESEARCH CENTER.
A Curriculum for Water Supply and Wastewater Operation, Maintenance and Management,
W83-00247 5G

DOW CHEMICAL CO., TULSA, OK. DOWELL DIV.
Improvement in Coal Preparation-Water Clarification Through Polymer Flocculation,
W83-00177 5D

E.V.S. CONSULTANTS, LTD., VANCOUVER (BRITISH COLUMBIA).
Design of Monitoring Studies for Priority Pollutants,
W83-00321 7A

EAST BAY MUNICIPAL UTILITY DISTRICT, OAKLAND, CA.
Cathodic Protection of Water Mains,
W83-00175 8G

ENGINEERING TECHNOLOGY, INC., NEW ORLEANS, LA.
Tracing Well Water Pollution in a Limestone Aquifer,
W83-00173 5B

ENVIRONMENTAL RESEARCH LAB., GULF BREEZE, FL.
Polynuclear Aromatic Hydrocarbons and Cellular Proliferative Disorders in Bivalue Molluscs from Oregon Estuaries,
W83-00295 5C

FLORIDA UNIV., GAINESVILLE. SCHOOL OF FOREST RESOURCES AND CONSERVATION.
Pine Tree Evapotranspiration,
W83-00279 2D

FLOW GENERAL, INC., MCLEAN, VA.
An Overview of Acid Rain Monitoring Activities in North America,
W83-00189 5C

FORD MOTOR CO., DEARBORN, MI. CHEMISTRY DEPT.
Biooxidation of Paint Process Wastewater, W83-00143 5D

FOREST SERVICE, ATLANTA, GA.
Developing a USLE Cover-Management (C) Factor Procedure for Forest Conditions, W83-00108 4D

FRESHWATER BIOLOGICAL ASSOCIATION, AMBLESIDE (ENGLAND).
The Development of Attenuance Depth-Profiling to Follow the Changing Distribution of Phytoplankton and Other Particulate Material in a Productive English Lake, W83-00055 5C

GATES (W. E.) AND ASSOCIATES, INC., BATAVIA, OH.
Effective Graphical Display of Water Resource Planning Information for Decision Makers, Volume I, W83-00273 10D

Effective Graphical Display of Water Resources Planning Information for Decision Makers, Volume II, W83-00274 10D

GEOLOGICAL SURVEY, ALBANY, NY. WATER RESOURCES DIV.
Geohydrology of the Valley-Fill Aquifer in the Schenectady Area, Schenectady County, New York, W83-00116 7C

Geohydrology of the Valley-Fill Aquifer in the Corning Area, Steuben County, New York, W83-00117 7C

Water Resources Data for New York, Water Year 1981--Volume 3. Western New York. W83-00131 7C

GEOLOGICAL SURVEY, ALBANY, NY. WATER RESOURCES DIV.; AND NEW YORK STATE GEOLOGICAL SURVEY/STATE MUSEUM, ALBANY.
Geohydrology of the Valley-Fill Aquifer in the South Fallsburgh-Woodbourne Area, Sullivan County, New York, W83-00069 7C

GEOLOGICAL SURVEY, ALBUQUERQUE, NM. WATER RESOURCES DIV.
Water-Resources Investigations of the U.S. Geological Survey in New Mexico, Fiscal Year 1980. W83-00073 7A

Water Resources of the Rincon and Mesilla Valleys and Adjacent Areas, New Mexico, W83-00078 7C

GEOLOGICAL SURVEY, ANNAPOLIS, MD. WATER RESOURCES DIV.; AND GEOLOGICAL SURVEY, TOWSON, MD. WATER RESOURCES DIV.
Map Showing the Potentiometric Surface of the Magothy Aquifer in Southern Maryland, September 1981, W83-00115 7C

GEOLOGICAL SURVEY, BATON ROUGE, LA. WATER RESOURCES DIV.
Water Resources Data, Louisiana, Water Year 1981--Volume 2. Southern Louisiana. W83-00057 7C

Applications of Digital Modeling for Evaluating the Ground-Water Resources of the '2,000-Foot' Sand of the Baton Rouge Area, Louisiana, W83-00109 4B

GEOLOGICAL SURVEY, CARSON CITY, NV. WATER RESOURCES DIV.
Potential Flood and Debris Hazards at Cottonwood Cove, Lake Mead National Recreation Area, Clark County, Nevada, W83-00070 2E

GEOLOGICAL SURVEY, CARSON CITY, NV. WATER RESOURCES DIV.; AND GEOLOGICAL SURVEY, MENLO PARK, CA. WATER RESOURCES DIV.
The Hydrothermal System in Southern Grass Valley, Pershing County, Nevada, W83-00060 4B

GEOLOGICAL SURVEY, CHEYENNE, WY. WATER RESOURCES DIV.
Streamflows and Channels of the Green River Basin, Wyoming, W83-00122 4A

GEOLOGICAL SURVEY, COLUMBUS, OH. WATER RESOURCES DIV.
Floodflow Characteristics Related to Channel Geometry in Ohio, W83-00067 2E

GEOLOGICAL SURVEY, DENVER, CO.; AND BUREAU OF RECLAMATION, DENVER, CO. DENVER FEDERAL CENTER.
Characterization of Organic Contaminants in Environmental Samples Associated with Mount St. Helens 1980 Volcanic Eruption, W83-00161 5A

GEOLOGICAL SURVEY, DENVER, CO. WATER RESOURCES DIV.
Large-Scale Bedforms in the Platte River Downstream from Grand Island, Nebraska: Structure Process, and Relationship to Channel Narrowing, W83-00111 4D

GEOLOGICAL SURVEY, FAIRFAX, VA. WATER RESOURCES DIV.
Low Flow of Streams in Fairfax County, Virginia, W83-00062 4C

GEOLOGICAL SURVEY, HELENA, MT. WATER RESOURCES DIV.
Annual Peak Discharges from Small Drainage Areas in Montana Through September 1981, W83-00071 2E

Selected Hydrologic and Climatologic Data from the Prairie Dog Creek Basin, Southeastern Montana, Water Year 1980, W83-00074 7C

Selected Hydrogeologic Data from Southern Sweet Grass County, South-Central Montana, W83-00076 7C

GEOLOGICAL SURVEY, HOUSTON, TX. WATER RESOURCES DIV.
Approximately Water-Level Changes in Wells in the Chicot and Evangeline Aquifers 1977-82 and 1981-82, and Measured Compaction 1973-82, in the Houston-Galveston Region, Texas, W83-00075 7C

GEOLOGICAL SURVEY, LAKEWOOD, CO.
Characterization of Plutonium in Ground Water Near the Idaho Chemical Processing Plant, W83-00019 5B

GEOLOGICAL SURVEY, LAKEWOOD, CO. WATER RESOURCES DIV.
Hydrologic Data for Urban Storm Runoff from Nine Sites in the Denver Metropolitan Area, Colorado, W83-00077 7C

Water-Quality Characteristics of Six Small, Semiarid Watersheds in the Green River Coal Region of Colorado, W83-00124 5A

Estimated Effects of Projected Ground-Water With-Drawals on Movement of the Saltwater Front in the Floridan Aquifer, 1976-2000, West-Central Florida, W83-00130 4B

GEOLOGICAL SURVEY, LAWRENCE, KS. WATER RESOURCES DIV.
Geohydrology of Southwestern Kansas, W83-00059 7C

Perennial-Streamflow Characteristics Related to Channel Geometry and Sediment in Missouri River Basin, W83-00121 4D

GEOLOGICAL SURVEY, LITTLE ROCK, AR. WATER RESOURCES DIV.
Report of the Annual Yield of the Arkansas River Basin for the Arkansas River Basin Compact, Arkansas--Oklahoma, 1980 Water Year, W83-00063 4A

GEOLOGICAL SURVEY, MADISON, WI. WATER RESOURCES DIV.
Water-Quality Assessment of Steiner Branch Basin, Lafayette County, Wisconsin, W83-00123 4A

GEOLOGICAL SURVEY, MEMPHIS, TN. WATER RESOURCES DIV.
Installation and Sampling of Observation Wells and Analyses of Water from the Shallow Aquifer at Selected Waste-Disposal Sites in the Memphis Area, Tennessee, W83-00066 5B

GEOLOGICAL SURVEY, MENLO PARK, CA. WATER RESOURCES DIV.
An Appraisal of Surface-Water Quality in the Alameda Creek Basin, California, October 1974-June 1979, W83-00064 5B

Chemical and Isotopic Composition of Water from Thermal and Mineral Springs of Washington, W83-00112 2K

Methods for Collection and Analysis of Geopressured Geothermal and Oil Field Waters, W83-00127 2K

GEOLOGICAL SURVEY, OKLAHOMA CITY, OK. WATER RESOURCES DIV.
Hydrologic Data for the Alluvium and Terrace Aquifer of the Beaver-North Canadian River from the Panhandle to Canton Reservoir, Northwestern Oklahoma, W83-00110 7C

GEOLOGICAL SURVEY, RALEIGH, NC. WATER RESOURCES DIV.
Manual for Leveling at Gaging Stations in North Carolina, W83-00065 7B

Water Resources Data for North Carolina, Water Year 1981. W83-00132 7C

GEOLOGICAL SURVEY, RESTON, VA.
U.S. Geological Survey Federal-State Program, W83-00201 6E

GEOLOGICAL SURVEY, RESTON, VA. WATER RESOURCES DIV.
Summary Appraisals of the Nation's Ground-Water Resources--New England Region, W83-00120 4B

A Study of Trends in Total Phosphorus Measurements at Nasqan Stations, W83-00126 5B

GEOLOGICAL SURVEY, RESTON, VA. WATER RESOURCES DIV.

Investigation of Trends in Flooding in the Tug Fork Basin of Kentucky, Virginia, and West Virginia,
W83-00128 4A

GEOLOGICAL SURVEY, SAN JUAN, PR. WATER RESOURCES DIV.
Geohydrologic Descriptions of Selected Solid-Waste Disposal Sites,
W83-00072 5B

GEOLOGICAL SURVEY, ST. PAUL, MN. WATER RESOURCES DIV.
Designation of Principal Water-Supply Aquifers in Minnesota,
W83-00125 2F

GEOLOGICAL SURVEY, TACOMA, WA. WATER RESOURCES DIV.
Finite Element Glacier Dynamics Model Applied to Columbia Glacier, Alaska,
W83-00118 2C

Continuity Equation Model of the Predicted Drastic Retreat of Columbia Glacier, Alaska,
W83-00119 2C

GEOLOGICAL SURVEY, TALLAHASSEE, FL. WATER RESOURCES DIV.
Effects of Effluent Spray Irrigation on Ground Water at a Test Site Near Tarpon Springs, Florida,
W83-00068 5B

Quality of Surface Water at Selected Sites in the Suwannee River Basin, Florida, 1980,
W83-00113 7C

Deep Artesian Aquifers of Sanibel and Captiva Islands, Lee County, Florida,
W83-00114 4B

Hydrogeology and Results of Injection Tests at Waste-Injection Test Sites in Pinellas County, Florida,
W83-00129 5B

GEOLOGICAL SURVEY, TOWSON, MD. WATER RESOURCES DIV.
Carroll County Ground-Water Information: Well Records, Spring Records, and Chemical-Quality Data.
W83-00058 7C

GEOLOGICAL SURVEY, TRENTON, NJ. WATER RESOURCES DIV.
Low-Flow Characteristics and Flow Duration of New Jersey Streams,
W83-00061 7C

GEORGIA UNIV., ATHENS. DEPT. OF MATHEMATICS.
Persistence in Model Ecosystems,
W83-00294 5B

GREAT SMOKY MOUNTAINS NATIONAL PARK, GATLINBURG, TN. UPLANDS FIELD RESEARCH LAB.
Water Quality of Streams in the Great Smoky Mountains National Park,
W83-00032 5B

GUAM UNIV., AGANA. WATER AND ENERGY RESEARCH INST. OF THE WESTERN PACIFIC.
Remote Sensing of Water Resources on Pacific Islands,
W83-00262 7C

Assessment of Low Head, Micro Hydroelectric Equipment for Use on Small Tropical Islands,
W83-00268 8C

A Preliminary Study of Natural Aquifer Discharge of Guam,
W83-00271 5B

GULF COAST RESEARCH LAB., OCEAN SPRINGS, MS. DEPT. OF ANALYTICAL CHEMISTRY.
Heavy Metals in Oysters and Clams of St. Louis Bay, Mississippi,
W83-00159 5C

GULF SOUTH RESEARCH INST., NEW ORLEANS, LA.
Development of Novel Porous Substrates for Ultrafiltration, Desalination and Water Reclamation--Part III,
W83-00259 3A

HAWAII UNIV., HONOLULU. WATER RESOURCES RESEARCH CENTER.
Water Quality Simulation of Wahiawa Reservoir, O'Ahu, Hawaii,
W83-00281 5G

HEIDELBERG UNIV. (GERMANY, F.R.). INST. OF ENVIRONMENTAL PHYSICS.
Factors Controlling Stable Isotope Composition of European Precipitation,
W83-00176 2B

HINSDALE SANITARY DISTRICT, IL.
Digester Control Pays Dividends,
W83-00192 5D

HYDROLOGICAL RESEARCH INST., PRETORIA (SOUTH AFRICA).
The Chemical Composition of Water and the Analytical Chemist: A Challenge,
W83-00290 5A

IBM CORP., HOUSTON, TX.
Improvements in Foam Flotation for Lead Removal,
W83-00150 5D

IDAHO UNIV., MOSCOW. COLL. OF ENGINEERING.
Non-Point Pollution Control for Rangeland Wintering, Livestock Operations (Ground Cover),
W83-00252 5G

IDAHO UNIV., MOSCOW. DEPT. OF CIVIL ENGINEERING.
Assessment of the Usefulness of Hydrologic Data for Hydropower Feasibility Analysis,
W83-00251 2E

ILLINOIS UNIV. AT URBANA-CHAMPAIGN. DEPT. OF CIVIL ENGINEERING.
Removing Soluble Organic Contaminants by Lime-Softening,
W83-00172 5F

ILLINOIS UNIV. AT URBANA-CHAMPAIGN. DEPT. OF ENVIRONMENTAL ENGINEERING.
New Technology for Drinking Water Treatment,
W83-00198 5F

IMPERIAL COLL. OF SCIENCE AND TECHNOLOGY, LONDON (ENGLAND). PUBLIC HEALTH ENGINEERING LAB.
The Influence of Process Parameters on the Removal of Heavy Metals in Activated Sludge,
W83-00327 5D

INSTITUTE FOR LAND AND WATER MANAGEMENT RESEARCH, WAGENINGEN (THE NETHERLANDS).
Anaerobic Digestion of Free Volatile Fatty Acids in Soils Below Waste Tips,
W83-00326 5D

INSTITUTE OF HYDROLOGY, WALLINGFORD (ENGLAND).
Practical Techniques of River Monitoring and Pollution Forecasting,
W83-00238 5B

INSTITUTE OF OCEAN SCIENCES, SIDNEY (AUSTRALIA).
In Situ Response of Phytoplankton Fluorescence to Rapid Variations in Light,
W83-00141 5C

INSTITUTO NACIONAL DE LIMNOLOGIA, SANTO TOME (ARGENTINA).
A Principal Components Analysis of the Phytoplankton from a Pond in the Parana River Valley, Argentina,
W83-00022 5C

INTERNATIONAL INST. FOR APPLIED SYSTEMS ANALYSIS, LAXENBURG (AUSTRIA).
The Probability Distribution of Water Inputs and the Economic Benefits of Supplementary Irrigation,
W83-00016 6A

IOWA STATE UNIV., AMES.
Dendrography for Optimal Water and Energy Utilization in Plant Growth,
W83-00265 3F

IOWA STATE UNIV., AMES. DEPT. OF BOTANY.
The Effects of Excessive Nitrogen and Phosphorus in Surface Waters of a Prairie Marsh,
W83-00266 5G

IOWA STATE UNIV., AMES. DEPT. OF CIVIL ENGINEERING.
Soil Characterization and Alternate Shoreline Erosion Control Measures for Constructed Lakes in Iowa,
W83-00218 4D

Rural Water Supply Systems: Improved Planning Strategies Through Systems Analysis,
W83-00241 6A

IOWA STATE WATER RESOURCES RESEARCH INST., AMES.
Efficient Use of Water for Irrigation in the Upper Midwest,
W83-00242 3F

Nitrate Movement and Denitrification Defined Relative to Bromide Tracer in Tile-Drained Land,
W83-00264 5B

IOWA UNIV., IOWA CITY. DEPT. OF CIVIL ENVIRONMENTAL ENGINEERING.
High pH Stabilization of Wastewater Sludge Using Chemical Softening Wastes From Water Treatment,
W83-00243 5D

IOWA UNIV., IOWA CITY. INST. OF HYDRAULIC RESEARCH.
Application to the Des Moines River of Multiple Reservoir Operating Strategies Incorporating Short-and Long-Term Information in Real Time,
W83-00248 4A

IOWA UNIV., IOWA CITY. IOWA INST. OF HYDRAULIC RESEARCH.
IIHR Distrubuted Parameter Watershed Model,
W83-00269 2E

ISRAEL OCEANOGRAPHIC AND LIMNOLOGICAL RESEARCH LTD., TIBERIAS; AND KINNERET LIMNOLOGY LAB., TIBERIAS (ISRAEL).
The Relationship Between Nutrient Status and Chemical Composition of Peridinium Cinctum During the Bloom in Lake Kinneret,
W83-00333 5C

JOHNSON SCREENS EUROPE OFFICE, LONDON (ENGLAND).
Groundwater is the Answer to Zambia's Water Problem,
W83-00225 4B

JONKERSHOEK FOREST RESEARCH STATION, STELLENBOSCH (SOUTH AFRICA).
Influence of Prescribed Burning on Nutrient Budgets of Mountain Fynbos Catchments in the S. W. Cape, Rep. of South Africa,
W83-00304 5B

JYVASKYLA UNIV. (FINLAND). DEPT. OF CELL BIOLOGY.
The Fate of 2,4,6-Trichlorophenol in an Aquatic Continuous-Flow System,
W83-00332 5B

KENT STATE UNIV., OH. DEPT. OF BIOLOGICAL SCIENCES.
Stratigaphic Diatom and Chemical Evidence for Acid Strip-Mine Lake Recovery,
W83-00329 2H

KENTUCKY WATER RESOURCES RESEARCH INST., LEXINGTON.
Some Variations in Distribution of Fishes in Large Mainstream Reservoirs Associated with Artificial Cover,
W83-00255 8I

Groundwater in the Inner Bluegrass Karst Region, Kentucky,
W83-00275 2F

KERALA UNIV., TRIVANDRUM (INDIA). DEPT. OF AQUATIC BIOLOGY AND FISHERIES.
Seasonal Variation of Zooplankton of the Veli Lake, South-West Coast of India,
W83-00027 2H

KERNFORSCHUNGSANLAGE JUELICH G.M.B.H. (GERMANY, F.R.). INST. FUER CHEMIE.
Differential Pulse Polarography of Some Herbicides Derived From 2,4-Dichlorophenoxyacetic Acid, II. Determination of Herbicide Residues in Irrigation Waters,
W83-00045 5A

KERNFORSCHUNGSANLAGE, JUELICH (GERMANY, F.R.). INST. FUER BIOTECHNOLOGIE III.
Investigations on the Lakes of Peru and Their Phytoplankton. 6 Additional Chemical Analyses,
W83-00037 2H

KRAEGER ASSOCIATES, LTD., APTOS, CA.
Social and Political Aspects of Drought,
W83-00186 6B

LEWIS AND CLARK LAW SCHOOL, PORTLAND, OR.
The Clean Water Act's Section 404 Permit Program Enters its Adolescence: An Institutional and Programmatic Perspective,
W83-00210 5G

LIMNOLOGICAL INST., OOSTERZEE (NETHERLANDS). TJEUKEMEER LAB.
Metal Binding Capacity in Relation to Hydrology and Algal Periodicity in Tjeukemeer, the Netherlands,
W83-00039 5B

LIVERPOOL UNIV. (ENGLAND) DEPT. OF BOTANY.
The Ecological Effects of 2-Methylthiotriazine Herbicides used for Aquatic Weed Control in Navigable Canals, II. Effects on Macroinvertebrate Fauna, and General Discussion,
W83-00343 5C

LOUISIANA WATER RESOURCES RESEARCH INST., BATON ROUGE.
Algae Removal by Induced Air Flotation,
W83-00277 5G

LOUVAIN UNIV. (BELGIUM). LAB. OF GENERAL AND EXPERIMENTAL ECOLOGY.
Some Aspects of the Colonization by Water Mites (Acari, Actinedida) of an Artifical Substrate in a Disturbed Environment,
W83-00054 5C

LOUVAIN UNIV. (BELGIUM). LAB. OF INDUSTRIAL MICROBIOLOGY AND BIOCHEMISTRY.
Investigations on Cellulose Biodegradation in Activated Sludge Plants,
W83-00013 5D

MAJ AND TOR NESSLING FOUNDATION, HELSINKI (FINLAND).
Dynamics of Phytoplankton in Finnish Lakes,
W83-00153 5C

MANVILLE SERVICE CORP., DENVER, CO.
Diatomite Precoat Filtration for Pretreatment of Seawater Prior to Reverse Osmosis,
W83-00270 3A

MARYLAND EASTERN SHORE UNIV., PRINCESS ANNE. DEPT. OF NATURAL SCIENCE.
Potential Applications of Water Hyacinth for Water, Air Recycling in Closed Systems,
W83-00324 5G

MARYLAND UNIV., COLLEGE PARK. DEPT. OF METEOROLOGY.
Climatic Aspects of Droughts,
W83-00188 3F

MASSACHUSETTS INST. OF TECH., CAMBRIDGE. DEPT. OF MECHANICAL ENGINEERING.
Hydrodynamics and Fouling of Pressure Driven Membrane Desalination and Water Treatment Systems,
W83-00244 3A

MASSACHUSETTS UNIV., AMHERST. DEPT. OF FOOD AND RESOURCE ECONOMICS.
Lump Sum Tax Loss Reimbursement Under the Thames River Flood Control Compact,
W83-00005 6B

MASSACHUSETTS UNIV., AMHERST. SCHOOL OF HEALTH SCIENCES.
Seasonal Changes of Dissolved Sodium in the Connecticut River Near Northfield, Massachusetts,
W83-00139 5B

MEMBRANE SYSTEMS, INC., SAN DIEGO, CA.
Development of Chlorine Resistant Membranes, Polyimide Membranes and Porous Substrates,
W83-00246 3A

MICHIGAN DEPT. OF NATURAL RESOURCES, LANSING.
Effects of Michigan's Phosphorus Detergent Ban on Municipal Chemical Costs,
W83-00147 5G

MICHIGAN STATE UNIV., EAST LANSING. DEPT. OF CROP AND SOIL SCIENCE.
Nitrate Contamination of Groundwater on the Old Mission Peninsula: Contribution of Land Reshaping and Septic Drainfields,
W83-00228 5B

MICHIGAN STATE UNIV., EAST LANSING. INST. OF WATER RESEARCH.
A Cooperative Water Resource Technology Transfer Program,
W83-00216 6B

MICHIGAN UNIV., ANN ARBOR. DEPT. OF ENVIRONMENT AND WATER RESOURCES ENGINEERING.
Adsorption of Toxic and Carcinogenic Compounds from Water,
W83-00171 5F

MICHIGAN UNIV., ANN ARBOR. DEPT. OF ENVIRONMENTAL AND INDUSTRIAL HEALTH.
Association Studies of Polybrominated Biphenyls in Aquatic Systems,
W83-00160 5B

MICHIGAN UNIV., ANN ARBOR. SCHOOL OF PUBLIC HEALTH.
Coliform Attachment to Suspended Particles in Stormwater,
W83-00224 5B

MICHIGAN UNIV., EAST LANSING. DEPT. OF ZOOLOGY.
Reevaluation of the Effects of Deicing Salt Runoff on a Small Urban Lake,
W83-00227 5C

MILJOSTYRELSEN, SILKEBORG (DENMARK). FRESHWATER LAB.
Storage of Carbon and Transport of Oxygen in River Macrophytes: Mass-Balance, and the Measurement of Primary Productivity in Rivers,
W83-00051 5B

MISSOURI UNIV.-ROLLA. DEPT. OF CHEMICAL ENGINEERING.
A Study of Glow Discharge Polymerization as a Means of Preparing Composite Reverse Osmosis Membranes with Ultrathin Skin,
W83-00260 3A

MONTANA STATE UNIV., BOZEMAN. DEPT. OF CIVIL ENGINEERING AND ENGINEERING MECHANICS.
Rapid-Mix Design for Mechanisms of Alum Coagulation,
W83-00170 5F

MONTANA STATE UNIV., BOZEMAN. DEPT. OF PLANT AND SOIL SCIENCE.
Soil Maps of Montana,
W83-00237 7C

MONTGOMERY (JAMES M.), INC., PASADENA, CA.
Water Quality Criteria and Effluent Requirements in Broward County, Florida,
W83-00320 5G

NAGOYA UNIV. (JAPAN). WATER RESEARCH INST.
Nitrogen Metabolism in Lake Kizaki, Japan. III. Active Nitrification in Early Summer,
W83-00040 2H

Nitrogen Metabolism in Lake Kizaki, Japan I. Ammonium and Nitrate Uptake by Phytoplankton,
W83-00344 2H

Nitrogen Metabolism in Lake Kizaki, Japan II. Distribution and Decomposition of Organic Nitrogen,
W83-00345 2H

NAIROBI UNIV. (KENYA). DEPT. OF ZOOLOGY.
Species Composition and Distribution of Zooplankton in a Tropical Lake, Lake Naivasha, Kenya,
W83-00056 5B

NATAL UNIV., DURBAN (SOUTH AFRICA). DEPT. OF AGRICULTURAL ENGINEERING.
Hydrology and Water Resources of the Drakensberg,
W83-00085 4A

NATIONAL INST. FOR WATER RESEARCH, PRETORIA (SOUTH AFRICA).
The Characterization and Processing of Lime Sludges from Water Reclamation Plants,
W83-00086 5D

NATIONAL INST. FOR WATER RESEARCH, PRETORIA (SOUTH AFRICA).

Solid Waste Management in South Africa,
W83-00090 5G

Simple Control Tests for Operators of Small Wastewater Treatment Plants,
W83-00092 5D

Algal Concentration and Species Composition in Experimental Maturation Ponds with Effects of Aeration and Recirculation,
W83-00284 5D

NATIONAL INST. FOR WATER RESEARCH, PRETORIA (SOUTH AFRICA). LIMNOLOGY DIV.
Applicability of Phosphorus Budget Models to Southern African Man-Made Lakes,
W83-00025 5C

NEBRASKA UNIV.-LINCOLN. COLL. OF LAW.
Analysis of Legal and Institutional Arrangements Affecting Water Allocation and Use in Nebraska,
W83-00250 6E

NEBRASKA UNIV., LINCOLN. DEPT. OF AGRICULTURAL ENGINEERING.
Irrigation Scheduling,
W83-00310 3F

NEBRASKA UNIV.-LINCOLN. INST. OF AGRICULTURE AND NATURAL RESOURCES.
Variability in Crop Physiological and Morphological Characteristics Controlling Water Use Efficiency and Grain Yield,
W83-00234 3F

NEVADA UNIV. SYSTEM, RENO. DESERT RESEARCH INST.
Ho: For Reese River Natural Resources of the Toiyabe-Toquima Highlands, Central Nevada,
W83-00253 6B

NEW HAVEN WATER CO., CT.
West River Gets Innovative Technology,
W83-00197 5F

NEW MEXICO STATE UNIV., LAS CRUCAS. DEPT. OF AGRICULTURAL ENGINEERING.
Water-Use Production Functions of Selected Agronomic Crops in Northwestern New Mexico, Phase I,
W83-00235 3F

NEW MEXICO STATE UNIV., LAS CRUCES. DEPT. OF AGRICULTURAL BUSINESS.
High Plains-Ogallala Aquifer Study, New Mexico -- Economic Impacts,
W83-00308 6B

NEW MEXICO STATE UNIV., LAS CRUCES. DEPT. OF AGRONOMY.
Conservation Through Crops Research,
W83-00311 3F

NEW MEXICO STATE UNIV., LAS CRUCES. DEPT. OF CHEMICAL ENGINEERING.
Water Treatment for Small Public Supplies,
W83-00280 5F

NORTH CAROLINA DEPT. OF NATURAL RESOURCES AND COMMUNITY DEVELOPMENT, RALEIGH. DIV. OF ENVIRONMENTAL MANAGEMENT.
Water Quality in Urban Streams--What we can Expect,
W83-00144 5C

NORTH CAROLINA UNIV. AT CHAPEL HILL. DEPT. OF ENVIRONMENTAL SCIENCES AND ENGINEERING.
Structural Characterization of Aquatic Humic Material,
W83-00190 5C

NORTH CENTRAL FOREST EXPERIMENT STATION, GRAND RAPIDS, MN.
Nutrient Removal From Wastewater by Wetlands,
W83-00226 5D

NORWEGIAN INST. FOR WATER RESEARCH, OSLO (NORWAY).
Adsorption of PAH to Aquatic Humus,
W83-00038 5B

OAK RIDGE NATIONAL LAB., TN. ENVIRONMENTAL SCIENCES DIV.
Phytoplankton Contribution to Alkaline Phosphatase Activity,
W83-00041 2H

Transport of Organic Carbon to the Oceans by Rivers of North America: A Synthesis of Existing Data,
W83-00174 5B

OKLAHOMA UNIV., NORMAN. DEPT. OF ZOOLOGY.
Distribution of Chironomids in the Littoral Zone of Lake Texoma, Oklahoma and Texas,
W83-00031 2H

ORANGE FREE STATE UNIV., BLOEMFONTEIN (SOUTH AFRICA). INST. FOR ENVIRONMENTAL SCIENCE.
Stabilizing High-Strength Wastes with Photosynthetic Bacteria,
W83-00181 5D

ORANGE FREE STATE UNIV., BLOEMFONTEIN (SOUTH AFRICA). INST. FOR ENVIRONMENTAL SCIENCES.
Preliminary Studies on the Treatment of Canning Factory Effluent with an Integrated Bacterial-Algal-Fish System,
W83-00317 5D

OTTAWA-CARLETON REGIONAL MUNICIPALITY (ONTARIO). WORKS DEPT.
Stormwater Runoff Treatment by Impoundment: Barrhaven Pilot Study,
W83-00083 5D

PACIFIC NORTHWEST LAB., RICHLAND, WA. DEPT. OF ECOLOGICAL SCIENCES.
Observations on the Bioaccumulation Potential of Thorium and Uranium in Rainbow Trout (Salmo Gairdneri),
W83-00021 5C

PACIFIC SOUTHWEST FOREST AND RANGE EXPERIMENT STATION. GLENDORA, CA.
Role of Fungi in Postfire Stabilization of Chaparral Ash Beds,
W83-00302 4D

PAN AMERICAN HEALTH ORGANIZATION, WASHINGTON, DC.
Developing and Applying International Water Quality Guidelines,
W83-00167 5G

PENNSYLVANIA STATE UNIV., UNIVERSITY PARK.
Lake Restoration Technology Transfer Assessment,
W83-00215 5G

PENNSYLVANIA STATE UNIV., UNIVERSITY PARK. COLL. OF AGRICULTURE.
The Laurel Run Acid Mine Drainage Renovation Demonstration Facility: An Evaluation,
W83-00258 5G

PENNSYLVANIA STATE UNIV., UNIVERSITY PARK. INST. FOR RESEARCH ON LAND AND WATER RESOURCES.
Hazardous Waste Technology Transfer Assessment,
W83-00276 5E

PHILIP M. BOTCH AND ASSOCIATES, BELLEVUE, WA.
Adenosine Triphosphate as a Control Parameter for Activated Sludge Processes,
W83-00149 5D

PIRNIE (MALCOLM), INC., WHITE PLAINS, NY.
Control Measures for Groundwater VOCS,
W83-00199 5F

PRESTON HALL HOSPITAL, MAIDSTONE (ENGLAND). PUBLIC HEALTH LAB.
The Incidence of Vibrio Cholerae in Water, Animals and Birds in Kent, England,
W83-00012 5B

PRETORIA, SOUTH AFRICA, NATIONAL INST. FOR WATER RESEARCH, PRETORIA (SOUTH AFRICA).
Chemical Stability of Water.
W83-00091 5F

PROCTER AND GAMBLE CO., CINCINNATI, OH. ENVIRONMENTAL SAFETY DEPT.
Mineralization of Linear Alcohol Ethoxylates and Linear Alcohol Ethoxy Sulfates at Trace Concentrations in Estuarine Water,
W83-00211 5B

PROVINCIAL WATER AUTHORITY, ZWOLLE (NETHERLANDS). DEPT. OF WATERSHED MANAGEMENT.
Some Notes on the Ecology of Aquatic Oligochaetes in the Delta Region of the Netherlands,
W83-00035 2L

PURDUE UNIV., LAFAYETTE, IN.
Spreading Lagooned Sewage Sludge on Farmland: A Case History,
W83-00296 5E

PURDUE UNIV., LAFAYETTE, IN. DEPT. OF AGRICULTURAL ENGINEERING.
Relation of USLE Factors to Erosion on Rangeland,
W83-00096 2J

Special Problems in the Application of the USLE to Rangelands: C and P Factors,
W83-00100 2J

Estimating Sediment Yield from Rangeland with CREAMS,
W83-00103 2J

PURDUE UNIV. LAFAYETTE, IN. WATER RESOURCES RESEARCH CENTER.
Stochastic Daily Precipitation Modeling and Daily Streamflow Transfer Processes,
W83-00282 2E

QUEEN'S UNIV., KINGSTON (ONTARIO). DEPT. OF BIOLOGY.
The Recent Histories of Three Canadian Shield Lakes: A Paleolimnological Experiment,
W83-00042 5C

RAND AFRIKAANS UNIV., JOANNESBURG (SOUTH AFRICA). DEPT. OF BOTANY.
The Occurrence of a Fungal Parasite on a Tetraselmis (Prasinophyceae) Species,
W83-00288 5C

READING UNIV. (ENGLAND). DEPT. OF CHEMISTRY.
Preconcentration of Environmental Tin and its Determination Using Catechol Violet,
W83-00348 5A

REEDY CREEK UTILITIES CO., INC., LAKE BUENA VISTA, FL.
Advanced Biological Treatment to Achieve Nutrient Removal,
W83-00349 5D

RHODE ISLAND UNIV., KINGSTON. SCHOOL OF OCEANOGRAPHY.
Anoxic Nutrient Regeneration and the Eutrophication of Estuarine Waters,
W83-00263 5C

RIJKSINSTITUUT VOOR DRINKWATERVOORZIENING, LEIDSCHENDAM (NETHERLANDS).
Determination of Boron in River Water with Flameless Atomic Absorption Spectrometry (Graphite Furnace Technique),
W83-00047 5A

ROCKWELL INTERNATIONAL, NEWBURY PARK, CA. ENVIRONMENTAL MONITORING AND SERVICES CENTER.
Treatment of Oily Wastewaters from Onshore Operations,
W83-00319 5D

ROCKY MOUNTAIN FOREST AND RANGE EXPERIMENT STATION, TEMPE, AZ.
Angora Goats for Conversion of Arizona Chaparral: Early Results,
W83-00299 3B

Stream Water Nutrient Changes Associated with the Conversion of Arizona Chaparral,
W83-00300 5B

Water Yield Changes Resulting from Treatment of Arizona Chaparral,
W83-00303 3B

RUTGERS-THE STATE UNIV., NEW BRUNSWICK, NJ. CENTER FOR COASTAL AND ENVIRONMENTAL STUDIES.
Land Application of Municipal Sludge with Regard to Cropping Systems and Pollution Potential,
W83-00233 5E

SANTA CLARA UNIV., CA. DEPT. OF CIVIL ENGINEERING.
Management and Control Technology for Urban Stormwater Pollution,
W83-00148 5G

SCIENCE AND EDUCATION ADMINISTRATION, AMES, IA.
Use of Rainfall Simulators to Determine Parameters for Erosion Prediction,
W83-00102 2J

SCIENCE AND EDUCATION ADMINISTRATION, BOISE, ID. NORTHWEST WATERSHED RESEARCH CENTER.
Predicting Sediment Yields from Sagebrush Rangelands,
W83-00106 4D

SCIENCE AND EDUCATION ADMINISTRATION, TUCSON, AZ.
Sediment Yield from Small Semiarid Rangeland Watersheds,
W83-00105 4D

SCIENCE AND EDUCATION ADMINISTRATION, TUCSON, AZ. SOUTHWEST RANGELAND WATERSHED RESEARCH CENTER.
The USLE Rainfall Factor for Southwestern U. S. Rangelands,
W83-00098 4D

Modeling Erosion in Overland Flow,
W83-00104 4D

SEVERN-TRENT WATER AUTHORITY, BIRMINGHAM (ENGLAND). DIRECTORATE OF SCIENTIFIC SERVICES.
Chemical Surveillance of Rivers,
W83-00134 5A

SEVERN-TRENT WATER AUTHORITY, MALVERN (ENGLAND). MALVERN REGIONAL LAB.
Pre-Concentration Technique for Cold-Vapour Atomic-Fluorescence Determination of Mercury in Drinking Waters,
W83-00195 5A

SOIL AND IRRIGATION RESEARCH INST. PRETORIA, (SOUTH AFRICA). DEPT. OF AGRICULTURAL TECHNICAL SERVICES.
A Weighing Lysimeter Facility at Roodeplaat for Crop Evapotranspiration Studies,
W83-00287 2D

SOUTHERN ILLINOIS UNIV. AT CARBONDALE. DEPT OF BOTANY.
Components Contributing to Light Extinction in Natural Water: Method of Isolation,
W83-00213 5A

SOUTHERN ILLINOIS UNIV. AT EDWARDSVILLE. ENVIRONMENTAL RESOURCES TRAINING CENTER.
Manpower Needs in Wastewater Treatment and Collection Systems for the Years 1980 to 2000,
W83-00180 5G

SOUTHERN RESEARCH INST., BIRMINGHAM, AL.
Preparation of Thin-Ion-Exchange Membranes with Exceptionally Low Resistances and High Selectivities.
W83-00261 3A

SRI INTERNATIONAL, MENLO PARK, CA.
Development and Demonstration of a Reverse-Osmosis Energy-Recovery Device,
W83-00256 3A

STANLEY ASSOCIATES ENGINEERING LTD., EDMO EDMONTON (ALBERTA); AND DEARBORN ENVIRONMENTAL CONSULTING SERVICES, MISSISSAUGA (ONTARIO).
Water and Waste Management in the Canadian Meat and Poultry Processing Industry.
W83-00082 3E

STATE UNIV. OF NEW YORK COLL. OF ENVIRONMENTAL SCIENCE AND FORESTRY, SYRACUSE. DEPT. OF ENVIRONMENTAL AND FOREST BIOLOGY.
Effects of the Burrowing Mayfly, Hexagenia, on Nitrogen and Sulfur Fractions in Lake Sediment Microcosms,
W83-00030 5C

STELLENBOSCH UNIV. (SOUTH AFRICA).
Adjustment of Soil Limitations,
W83-00286 2G

STRASBOURG-1 (FRANCE).
Measurement and Mapping of Potential Evapotranspiration in a Small Mountainous Watershed,
W83-00346 2D

SULZER BROS. LTD., WINTERTHUR (SWITZERLAND).
Wastewater Flocculation-Filtration and Post Disinfection,
W83-00239 5D

TAYLOR (JOHN) AND SONS, LONDON (ENGLAND).
Instrumental Methods of Monitoring and Control of Water and Wastewater Treatment Processes,
W83-00314 5F

TENNESSEE VALLEY AUTHORITY, KNOXVILLE, TN.
Municipal Point Source and Agricultural Nonpoint Source Contribution to Coastal Eutrophication,
W83-00001 5B

TEXAS AGRICULTURAL EXPERIMENT STATION, LUBBOCK.
Water Saving Techniques,
W83-00309 3F

TEXAS TECH UNIV., LUBBOCK. DEPT. OF INDUSTRIAL ENGINEERING.
Incentives for Irrigation Water Conservation in Agriculture,
W83-00278 3F

TEXAS UNIV. AT ARLINGTON. DEPT. OF CIVIL ENGINEERING.
Effect of a Bacterial Culture Product on Biological Kinetics,
W83-00212 5D

TEXAS UNIV. AT DALLAS.
Bioassay Technique for Relative Toxicity in Water Pollution Control,
W83-00146 5A

TEXAS UNIV. HEALTH SCIENCE CENTER AT HOUSTON. SCHOOL OF PUBLIC HEALTH.
Environmental Impact of Large Hydroelectric Projects on Tropical Countries,
W83-00010 6G

THOMAS (FRANK A.) AND ASSOCIATES, INC., WILLOUGHBY, OH.
Intensive Flow Monitoring--Cost-Effectiveness with a Quality Edge,
W83-00200 5G

TOKYO METROPOLITAN UNIV. (JAPAN). DEPT. OF BIOLOGY.
Distribution of Denitrifying Bacteria and its Controlling Factors in Freshwater Environments,
W83-00018 5C

TRW, LAKEWOOD, COLORADO, ENERGY ENGINEERING DIVISION.
Use of Mathematical Models to Predict Impacts of Mining Energy Minerals on the Hydrologic System in Northwestern Colorado,
W83-00168 4C

TUFTS UNIV., MEDFORD, MA.; AND NATIONAL COUNCIL FOR AIR AND STREAM IMPROVEMENT, INC., MEDFORD, MA.
Pulp and Paper Effluent Management,
W83-00164 5D

UNIVERSITAET DES SAARLANDES, SAARBRUECKEN (GERMANY, F.R.). DEPT. OF MICROBIOLOGY.
The Sediments of the New Artificial Lake Bostalsee (Saarland, Germany), with Particular Reference to Microbial Activity,
W83-00048 5C

UNIVERSITY COLL. OF SWANEA (WALES). CENTRE FOR DEVELOPMENT STUDIES.
Irrigation Planning in the Tana Basin of Kenya,
W83-00015 6B

UNIVERSITY OF SCIENCE AND TECHNOLOGY, KUMASI (GHANA). DEPT. OF BIOLOGICAL SCIENCES.
Diel Periodicity in the Chemical Composition of Lake Phytoplankton,
W83-00049 5B

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG (SOUTH AFRICA). DEPT. OF CONSTRUCTION MATERIALS.
The Flow of Slurry from a Breached Tailings Dam,
W83-00285 8B

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG (SOUTH AFRICA). HYDROLOGICAL RESEARCH UNIT.
A Depth-Duration-Frequency Diagram for Point Rainfall in Swa-Namibia,
W83-00289 2B

UPPSALA UNIV. (SWEDEN). DEPT. OF ENTOMOLOGY.

UPPSALA UNIV. (SWEDEN). DEPT. OF ENTOMOLOGY.
Paleoecological Studies of the Recent Development of the Lake Vaxjosjon. IV. Interpretation of the Eutrophication Process Through the Analysis of Subfossil Chironomids,
W83-00028 5C

UPPSALA UNIV. (SWEDEN). INST. LIMNOLOGY.
Characterization of Acid Phosphatases in the Acidified Lake Gardsjon, Sweden,
W83-00050 5C

UPPSALA UNIV. (SWEDEN). INST. OF LIMNOLOGY.
Induction of High Phosphatase Activity by Aluminum in Acid Lakes,
W83-00029 5B

UTAH STATE UNIV., LOGAN. WATERSHED SCIENCE UNIT.
A Test of the USLE on Bare and Sagebrush Plots in Utah,
W83-00101 4D

UTRECHT RIJKSUNIVERSITEIT (NETHERLANDS). ANALYTICAL CHEMISTRY LAB.
Determination of Organophosphorus and Organosulphur at the Sub-NG-Level for Use in Water Analysis,
W83-00046 5A

VIRGINIA COMMONWEALTH UNIV., RICHMOND. DEPT. OF BIOLOGY.
Littoral and Profundal Macroinvertebrate Communities of a Coastal Brown-Water Lake,
W83-00044 2H

VIRGINIA POLYTECHNIC INST. AND STATE UNIV., BLACKSBURG. DEPT. OF CIVIL ENGINEERING.
Water Law Primer,
W83-00318 6E

VIRGINIA UNIV., CHARLOTTESVILLE. DEPT. OF ENVIRONMENTAL SCIENCES.
The Ecology of the Mangroves of South Florida: A Community Profile,
W83-00093 6G

VIRGINIA WATER RESOURCES CENTER, BLACKSBURG.
Law,
W83-00165 6E

WASHINGTON STATE UNIV., PULLMAN.
Effects of Slope Length and Steepness on Soil Erosion from Rangelands,
W83-00099 2J

WASHINGTON UNIV., SEATTLE. DEPT. OF CIVIL ENGINEERING.
Reservoir Management in Potomac River Basin,
W83-00203 6A

Water Resource System Reliability Under Drought Conditions: The Seattle Water Supply System as a Case Study,
W83-00229 3D

WATER RESEARCH CENTRE (ENGLAND).
The Effects of the Disposal of Sewage Effluents on Groundwater Quality in the United Kingdom,
W83-00220 5E

WATER RESEARCH CENTRE, MARLOW (ENGLAND).
Accuracy of Determination of Ammoniacal Nitrogen in River Waters: Analytical Quality Control in the Harmonised Monitoring Scheme.
W83-00196 5A

WAYNE COUNTY DEPT. OF PUBLIC WORKS, WYANDOTTE, MI.
Recycling of Mercury and Silver from COD Tests,
W83-00145 5D

WESSEX WATER AUTHORITY, BRISTOL (ENGLAND). AVON AND DORSET RECOVERY DIV.
The Use of Oxygen to Uprate the Treatment Capacity of a Conventional Surface-Aeration Plant at Holdenhurst (Bournemouth) Sewage Treatment Works,
W83-00133 5D

WESTON (ROY F.), INC., WEST CHESTER, PA.
Evaluation and Control of Sidestreams Generated in Publicly Owned Treatment Works,
W83-00291 5D

WHITE (R. H.) CONSTRUCTION CO., INC., AUBURN, MA.
Design and Construction of the Pennichuck Water Treatment Plant: The Construction Manager's View,
W83-00136 5F

WISCONSIN UNIV.-MILWAUKEE. DEPT. OF CIVIL ENGINEERING.
Wastewater Management Problems in Rural Communities,
W83-00249 5G

WYOMING UNIV., LARAMIE. WATER RESOURCES, RESEARCH INST.
Evaluation of Limnological Parameters as Related to the Success of Mysis Relicta Introductions,
W83-00254 8I

Instream Salmonid Habitat Exclusion by Ice-Cover,
W83-00257 8I

ZULULAND UNIV. (SOUTH AFRICA). DEPT. OF BOTANY.
The Structure and Some Recent Changes of the Zoobenthic Community in the Ermatinger Becken, A Shallow Littoral Part of Lake Constance,
W83-00036 2H

ZURICH UNIV. (SWITZERLAND). HYDROBIOLOGICAL-LIMNOLOGICAL STATION.
Limnological Investigations of a Mountain Spring Pond in the Swiss National Park,
W83-00034 2H

ACCESSION NUMBER INDEX

W83-00001 5B
W83-00002 5B
W83-00003 5G
W83-00004 6D
W83-00005 6B
W83-00006 5C
W83-00007 4A
W83-00008 8G
W83-00009 5C
W83-00010 6G
W83-00011 6A
W83-00012 5B
W83-00013 5D
W83-00014 5A
W83-00015 6B
W83-00016 6A
W83-00017 6D
W83-00018 5C
W83-00019 5B
W83-00020 5F
W83-00021 5C
W83-00022 5C
W83-00023 5G
W83-00024 5G
W83-00025 5C
W83-00026 5C
W83-00027 2H
W83-00028 5C
W83-00029 5B
W83-00030 5C
W83-00031 2H
W83-00032 5B
W83-00033 2H
W83-00034 2H
W83-00035 2L
W83-00036 2H
W83-00037 2H
W83-00038 5B
W83-00039 5B
W83-00040 2H
W83-00041 2H
W83-00042 5C
W83-00043 5C
W83-00044 2H
W83-00045 5A
W83-00046 5A
W83-00047 5A
W83-00048 5C
W83-00049 5B
W83-00050 5C
W83-00051 5B
W83-00052 5C
W83-00053 5C
W83-00054 5C
W83-00055 5C
W83-00056 5B
W83-00057 7C
W83-00058 7C
W83-00059 7C
W83-00060 4B
W83-00061 7C
W83-00062 4C
W83-00063 4A
W83-00064 5B
W83-00065 7B
W83-00066 5B
W83-00067 2E
W83-00068 5B
W83-00069 7C
W83-00070 2E
W83-00071 2E
W83-00072 5B
W83-00073 7A
W83-00074 7C
W83-00075 7C
W83-00076 7C
W83-00077 7C
W83-00078 7C
W83-00079 5G
W83-00080 5D
W83-00081 7B
W83-00082 3E
W83-00083 5D
W83-00084 2B
W83-00085 4A
W83-00086 5D
W83-00087 4D
W83-00088 2B
W83-00089 2E
W83-00090 5G
W83-00091 5F
W83-00092 5D
W83-00093 6G
W83-00094 8G
W83-00095 7C
W83-00096 2J
W83-00097 2J
W83-00098 4D
W83-00099 2J
W83-00100 2J
W83-00101 4D
W83-00102 2J
W83-00103 2J
W83-00104 4D
W83-00105 4D
W83-00106 4D
W83-00107 4D
W83-00108 4D
W83-00109 4B
W83-00110 7C
W83-00111 4D
W83-00112 2K
W83-00113 7C
W83-00114 4B
W83-00115 7C
W83-00116 7C
W83-00117 7C
W83-00118 2C
W83-00119 2C
W83-00120 4B
W83-00121 4D
W83-00122 4A
W83-00123 4A
W83-00124 5A
W83-00125 2F
W83-00126 5B
W83-00127 2K
W83-00128 4A
W83-00129 5B
W83-00130 4B
W83-00131 7C
W83-00132 7C
W83-00133 5D
W83-00134 5A
W83-00135 5F
W83-00136 5F
W83-00137 5G
W83-00138 5D
W83-00139 5B
W83-00140 2J
W83-00141 5C
W83-00142 5D
W83-00143 5D
W83-00144 5C
W83-00145 5D
W83-00146 5A
W83-00147 5G
W83-00148 5G
W83-00149 5D
W83-00150 5D
W83-00151 5D
W83-00152 5D
W83-00153 5C
W83-00154 5D
W83-00155 5G
W83-00156 5D
W83-00157 5D
W83-00158 5A
W83-00159 5C
W83-00160 5B
W83-00161 5A
W83-00162 5G
W83-00163 5D
W83-00164 5D
W83-00165 6E
W83-00166 4A
W83-00167 5G
W83-00168 4C
W83-00169 5B
W83-00170 5F
W83-00171 5F
W83-00172 5F
W83-00173 5B
W83-00174 5B
W83-00175 8G
W83-00176 2B
W83-00177 5D
W83-00178 5C
W83-00179 5D
W83-00180 5G
W83-00181 5D
W83-00182 5A
W83-00183 5C
W83-00184 5B
W83-00185 5D
W83-00186 6B
W83-00187 5B
W83-00188 3F
W83-00189 5C
W83-00190 5C
W83-00191 5D
W83-00192 5D
W83-00193 6G
W83-00194 5A
W83-00195 5A
W83-00196 5A
W83-00197 5F
W83-00198 5F
W83-00199 5F
W83-00200 5G
W83-00201 6E
W83-00202 5A
W83-00203 6A
W83-00204 5A
W83-00205 8G
W83-00206 8C
W83-00207 8A
W83-00208 5C
W83-00209 6E
W83-00210 5G
W83-00211 5B
W83-00212 5D
W83-00213 5A
W83-00214 5B
W83-00215 5G
W83-00216 6B
W83-00217 4B
W83-00218 4D
W83-00219 5B
W83-00220 5E
W83-00221 5D
W83-00222 3A
W83-00223 6G
W83-00224 5B
W83-00225 4B
W83-00226 5D
W83-00227 5C
W83-00228 5B
W83-00229 3D
W83-00230 3F
W83-00231 5A
W83-00232 5D
W83-00233 5E
W83-00234 3F
W83-00235 3F
W83-00236 5E
W83-00237 7C
W83-00238 5B
W83-00239 5D
W83-00240 6B
W83-00241 6A
W83-00242 3F
W83-00243 5D
W83-00244 3A
W83-00245 5G
W83-00246 3A
W83-00247 5G
W83-00248 4A
W83-00249 5G
W83-00250 6E
W83-00251 2E
W83-00252 5G
W83-00253 6B
W83-00254 8I
W83-00255 8I
W83-00256 3A
W83-00257 8I
W83-00258 5G
W83-00259 3A
W83-00260 3A
W83-00261 3A
W83-00262 7C
W83-00263 5C
W83-00264 5B
W83-00265 3F
W83-00266 5G
W83-00267 3A
W83-00268 8C
W83-00269 2E
W83-00270 3A
W83-00271 5B
W83-00272 4A
W83-00273 10D
W83-00274 10D
W83-00275 2F
W83-00276 5E
W83-00277 5G
W83-00278 3F
W83-00279 2D
W83-00280 5F
W83-00281 5G
W83-00282 2E
W83-00283 5F
W83-00284 5D
W83-00285 8B
W83-00286 2G
W83-00287 2D
W83-00288 5C
W83-00289 2B
W83-00290 5A
W83-00291 5D
W83-00292 5A
W83-00293 5F
W83-00294 5B
W83-00295 5C
W83-00296 5E
W83-00297 6G
W83-00298 5E
W83-00299 3B
W83-00300 5B
W83-00301 4D
W83-00302 4D
W83-00303 3B
W83-00304 5B
W83-00305 2J
W83-00306 6B
W83-00307 2I
W83-00308 6B
W83-00309 3F
W83-00310 3F
W83-00311 3F
W83-00312 4A
W83-00313 8C
W83-00314 5F
W83-00315 5G
W83-00316 2H
W83-00317 5D
W83-00318 6E
W83-00319 5D
W83-00320 5G
W83-00321 7A
W83-00322 5G
W83-00323 2K
W83-00324 5G
W83-00325 5D
W83-00326 5D
W83-00327 5D
W83-00328 5D
W83-00329 2H
W83-00330 5B
W83-00331 5C
W83-00332 5B
W83-00333 5C
W83-00334 8A
W83-00335 5F
W83-00336 8G

W83-00337

W83-00337 5D
W83-00338 8C
W83-00339 8A
W83-00340 8C
W83-00341 5F
W83-00342 5F
W83-00343 5C
W83-00344 2H
W83-00345 2H
W83-00346 2D
W83-00347 2A
W83-00348 5A
W83-00349 5D
W83-00350 5D

Subject Fields

- 1 NATURE OF WATER
- 2 WATER CYCLE
- 3 WATER SUPPLY AUGMENTATION AND CONSERVATION
- 4 WATER QUANTITY MANAGEMENT AND CONTROL
- 5 WATER QUALITY MANAGEMENT AND PROTECTION
- 6 WATER RESOURCES PLANNING
- 7 RESOURCES DATA
- 8 ENGINEERING WORKS
- 9 MANPOWER, GRANTS, AND FACILITIES
- 10 SCIENTIFIC AND TECHNICAL INFORMATION

INDEXES

- SUBJECT INDEX
- AUTHOR INDEX
- ORGANIZATIONAL INDEX
- ACCESSION NUMBER INDEX

NORTH AMERICAN CONTINENT PRICE SCHEDULE

Customers in Canada, United States, and Mexico please use this price schedule; other addressees, write for Folder PR-360-4.

MICROFICHE		E01	$6.50	T01	$125.00
A01	$4.50	E02	7.50	T02	140.00
PAPER COPY		E03	9.50	T03	240.00
A02	7.00	E04	11.50	T04	320.00
A03	8.50	E05	13.50	T05	400.00
A04	10.00	E06	15.50	T06	443.00
A05	11.50	E07	17.50	T07	518.00
A06	13.00	E08	19.50	T08	595.00
A07	14.50	E09	21.50	T09	660.00
A08	16.00	E10	23.50	T10	725.00
A09	17.50	E11	25.50	T11	790.00
A10	19.00	E12	28.50	T12	855.00
A11	20.50	E13	31.50	T13	920.00
A12	22.00	E14	34.50	T14	985.00
A13	23.50	E15	37.50	T15	1,050.00
A14	25.00	E16	40.50	T16	1,115.00
A15	26.50	E17	43.50	T17	1,180.00
A16	28.00	E18	46.50	T18	1,245.00
A17	29.50	E19	51.50	T19	1,310.00
A18	31.00	E20	61.50	T99	**
A19	32.50	E99	**		
A20	34.00				
A21	35.50	N01	35.00		
A22	37.00	N02	40.00		
A23	38.50				
A24	40.00				
A25	41.50				
A99	*				

*Add $1.50 for each additional 25-page increment, or portion thereof.
**Contact NTIS for price quote.

PRICES EFFECTIVE JANUARY 1, 1983

U.S. DEPARTMENT OF COMMERCE
National Technical Information Service
5285 Port Royal Road
Springfield VA 22161

OFFICIAL BUSINESS

PRINTED MATTER

AN EQUAL OPPORTUNITY EMPLOYER

POSTAGE AND FEES PAID
U.S. DEPARTMENT OF COMMERCE
COM-211
Special Fourth-Class Rate
Book

U.S.MAIL

Doc
I1.94/2:
16/2

BOOKSTACKS
DOCUMENTS

PB83-910202

DEPOSITORY
MAR 2 3 1983
UNIVERSITY OF ILLINOIS
AT URBANA-CHAMPAIGN

SELECTED WATER RESOURCES ABSTRACTS

VOLUME 16, NUMBER 2
FEBRUARY 1983

W83-00351 -- W83-00700
CODEN: SWRABW

SELECTED WATER RESOURCES ABSTRACTS (SWRA) is produced by the Geological Survey, U.S. Department of the Interior, and published monthly by the National Technical Information Service (NTIS), U.S. Department of Commerce.

SWRA is available to Federal agencies and their contractors or grantees in water resources research upon request, citing contract or grant number and sponsoring agency. Write: Water Resources Division, U.S. Geological Survey, MS 421, Reston, VA 22092, U.S. Department of the Interior, Washington, DC 20240. The **SWRA Journal** is also available on subscription from NTIS, 5285 Port Royal Road, Springfield, VA 22161. Annual subscription rates for the North American Continent are:
Journal only, $100; Journal and Annual Indexes, $125; Indexes only, $50. Other addressees, write for prices.

Some documents abstracted in this journal can be purchased from NTIS. Price codes are given in the entries and a current code-price conversion table is printed on the outside back cover. Other documents are available from originating organizations or authors as indicated in the citation.

SELECTED WATER RESOURCES ABSTRACTS

A monthly publication of the Geological Survey
U.S. Department of the Interior

VOLUME 16, NUMBER 2
FEBRUARY 1983

W83-00351 -- W83-00700

The Secretary of the Interior has determined that the publication of the periodical is necessary in the transaction of the public business required by law of this Department.

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.

PREFACE

Selected Water Resources Abstracts, a monthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. These documents cover water resources as treated in the life, physical, and social sciences and the related engineering and legal aspects of the characteristics, supply condition, conservation, control, use, or management of water resources. Each abstract includes a full bibliographic citation and a set of descriptors which are listed in the **Water Resources Thesaurus.** The abstract entries are classified into 10 fields and 60 groups similar to the water resources research categories established by the Committee on Water Resources Research of the then Federal Council for Science and Technology.

Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientitsts, engineers, and managers as one of several services of the Water Resources Scientific Information Center. The cumulative SWRA file from 1968 and monthly updates are available also in magnetic tape through lease from NTIS.

THE WATER RESOURCES SCIENTIFIC INFORMATION CENTER DOES NOT PROVIDE COPIES OF DOCUMENTS ABSTRACTED IN THIS JOURNAL. Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources.

Comments and suggestions concerning the contents and arrangement of this bulletin are welcome.

Water Resources Scientific
Information Center
U.S. Geological Survey, MS 421
Reston, VA 22092

CONTENTS

SUBJECT FIELDS AND GROUPS

Please use the edge index on the back cover to locate Subject Fields and Indexes.

01 NATURE OF WATER

Includes the following Groups: Properties; Aqueous Solutions and Suspensions.

02 WATER CYCLE

Includes the following Groups: General; Precipitation; Snow, Ice, and Frost; Evaporation and Transpiration; Streamflow and Runoff; Groundwater; Water in Soils; Lakes; Water in Plants; Erosion and Sedimentation; Chemical Processes; Estuaries.

03 WATER SUPPLY AUGMENTATION AND CONSERVATION

Includes the following Groups: Saline Water Conversion; Water Yield Improvement; Use of Water of Impaired Quality; Conservation in Domestic and Municipal Use; Conservation in Industry; Conservation in Agriculture.

04 WATER QUANTITY MANAGEMENT AND CONTROL

Includes the following Groups: Control of Water on the Surface; Groundwater Management; Effects on Water of Man's Nonwater Activities; Watershed Protection.

05 WATER QUALITY MANAGEMENT AND PROTECTION

Includes the following Groups: Identification of Pollutants; Sources of Pollution; Effects of Pollution; Waste Treatment Processes; Ultimate Disposal of Wastes; Water Treatment and Quality Alteration; Water Quality Control.

06 WATER RESOURCES PLANNING

Includes the following Groups: Techniques of Planning; Evaluation Process; Cost Allocation, Cost Sharing, Pricing/Repayment; Water Demand; Water Law and Institutions; Nonstructural Alternatives; Ecologic Impact of Water Development.

07 RESOURCES DATA

Includes the following Groups: Network Design; Data Acquisition; Evaluation, Processing and Publication.

08 ENGINEERING WORKS

Includes the following Groups: Structures; Hydraulics; Hydraulic Machinery; Soil Mechanics; Rock Mechanics and Geology; Concrete; Materials; Rapid Excavation; Fisheries Engineering.

09 MANPOWER, GRANTS, AND FACILITIES

Includes the following Groups: Education—Extramural; Education—In-House; Research Facilities; Grants, Contracts, and Research Act Allotments.

10 SCIENTIFIC AND TECHNICAL INFORMATION

Includes the following Groups: Acquisition and Processing; Reference and Retrieval; Secondary Publication and Distribution; Specialized Information Center Services; Translations; Preparation of Reviews.

SUBJECT INDEX

AUTHOR INDEX

ORGANIZATIONAL INDEX

ACCESSION NUMBER INDEX

SELECTED WATER RESOURCES ABSTRACTS

1. NATURE OF WATER

1A. Properties

THERMAL SPRINGS IN THE SALMON RIVER BASIN, CENTRAL IDAHO,
Geological Survey, Boise, ID. Water Resources Div.
H. W. Young, and R. E. Lewis.
Available from the OFSS, USGS Box 25425, Fed. Ctr. Denver, CO 80225, Price: $6.25 in paper copy, $4.50 in microfiche. Geological Survey Open-File Report 82-104, February 1982. 27 p, 3 Fig, 2 Plates, 4 Tab, 17 Ref.

Descriptors: *Geothermal studies, *Thermal springs, *Chemical properties, *Physical properties, Water temperature, Chemical analysis, Stable isotopes, Radioisotopes, *Idaho, Salmon River basin, Idaho batholith.

The Salmon River basin drains approximately 13,000 square miles in central Idaho underlain by the Idaho batholith. Geologic units in the basin include igneous, sedimentary, and metamorphic rocks and granitic rocks predominate. Water from thermal springs ranges in temperature from 20.5 degrees to 94.0 degrees Celsius. The waters are slightly alkaline and are generally a sodium carbonate or bicarbonate type. Dissolved-solids concentrations are variable and range from 103 to 839 milligrams per liter. Estimated reservoir temperatures determined from the silicic acid-corrected silica, sodium-potassium-calcium, and sulfate-water isotope geothermometers range from 30 degrees to 184 degrees Celsius. Tritium concentrations in sampled thermal waters are near zero and indicate the waters are at least 100 years old and may be considerably older. Stable-isotope data indicate it is unlikely that a single area of recharge or a single hot-water reservoir supplies all hot springs in the basin. Thermal springs discharged at least 15,800 acre-feet of water in 1980. Associated convective heat flux is 27 million calories per second. (USGS)
W83-00552

2. WATER CYCLE

2A. General

GLACIAL-HYDROLOGICAL INVESTIGATIONS AT THE VERNAGTFERNER GLACIER AS A BASIS FOR A DISCHARGE MODEL,
Gesellschaft fuer Strahlenforschung m.b.H., Munich (Germany, F.R.). Inst. fuer Radiohydrometrie.
H. Oerter, D. Baker, H. Moser, and O. Reinwarth.
Nordic Hydrology, Vol 12, No 4/5, p 335-348, 1981. 8 Fig, 5 Tab, 11 Ref.

Descriptors: *Snowmelt, *Glaciers, Runoff volume, Mathematical models, Energy, Hydrographs, Alps, *Austria, *Vernagtfeoner glacier.

Data collected during glacial-hyd rological investigations at the Vernagtferner glacier in the Oetztal Alps, Austria, have been reviewed and utilized in the development of a deterministic discharge model. The gauge station 'Pegelstation Vernagtbach' has recorded the runoff from the glacier since 1974. The catchment area for the station is 11.44 square kilometers, with a mean altitude of 3,125 meters above sea level, and is 81% glaciated. Discharge hydrographs for the years 1974 through 1980 showed characteristic time intervals for the runoff and characteristic runoff components. The different discharge patterns exhibited by different parts of the glacier were used to develop spatial classification for the discharge formation and to describe the different hydraulic conditions. A mathematical model is proposed which uses four parallel linear reservoirs, which are characterized by linearity between water volume wi thin the reservoir and in the outflow, for which the storage constants had been previously determined. The model was used to calculate the runoff from the glacier for a 19-day period of dry and sunny weather using the energy balance on the glacier surface as the input data. The resultant calculated runoff was only slightly smaller than the runoff measured at the gauge station, demonstrating good agreement between calculated and measured data. (Carroll-FRC)
W83-00379

PROBABILITY OF ANNUAL FLOWS OF THE GREATER ZAB RIVER,
Clark (David) and Associates, Inc., Washington, DC.
For primary bibliographic entry see Field 2E.
W83-00457

A STORMWATER MANAGEMENT MODEL FOR THE WEST BRANCH BRANDYWINE CREEK, CHESTER COUNTY, PENNSYLVANIA,
Geological Survey, Harrisburg, PA. Water Resources Div.
For primary bibliographic entry see Field 4A.
W83-00562

A COMPUTER SIMULATION OF THE EFFECTS OF DIFFERING CROP TYPES ON THE WATER BALANCE OF SMALL CATCHMENTS OVER LONG TIME PERIODS,
Leeds Univ. (England). School of Geography.
For primary bibliographic entry see Field 2D.
W83-00585

THE IUH OF GENERAL HYDROLOGIC SYSTEM MODEL,
United Nations Educational, Scientific and Cultural Organization, Colombo (Sri Lanka).
V. F. Chow, and V. C. Kulandaiswamy.
Journal of the Hydraulics Division, Proceedings of the American Society of Civil Engineers, Vol 108, No HY7, p 830-844, July, 1982. 1 Tab, 6 Ref.

Descriptors: *Mathematical studies, *Unit hydrographs, *Hydrological models, *Systems analysis, *Rainfall, Differential equations, Boundary conditions, Hydrologic data, Model studies, Infiltration rate, Storage, Catchment basins, Storm runoff.

Two simple forms of the General Hydrologic system model (GHS) are described. Both a 5-parameter and a 3-parameter model are derived, and their instantaneous unit hydrographs (IUH) are compared. The GHS is a system of differential equations which describe continuity and storage in a given basin. For verification, the model was applied to 27 storm-runoff events that had occurred in six watersheds with different sizes. Results of the comparison between the 5-parameter and 3-parameter models suggest that the 5-parameter model is more realistic and fits the hydrologic data more consistently than the 3-parameter model. The advantage of the 3-parameter model is its simplicity; however, with computers to perform the computations, the 5-parameter model is superior overall. (Titus-FRC)
W83-00652

IMPROVEMENT OF NONLINEAR RAINFALL-RUNOFF MODEL,
California Univ., Davis. Dept. of Civil Engineering.
O. J. Helweg, J. Amorocho, and R. H. Finch.
Journal of the Hydraulics Division, Proceedings of the American Society of Civil Engineers, Vol 108, No HY7, p 813-822, July, 1982.

Descriptors: *Rainfall, *Mathematical models, *Rainfall-runoff relationships, Unit hydrographs, Systems analysis, Precipitation, Runoff, Watersheds, Hydrographs, Parametric hydrology, Synthetic hydrology, Model studies, Computer models, Hydrologic models, Nonlinear programming.

The Amorocho-Branstetter nonlinear rainfall-runoff model is discussed. It is an alternative to unit hydrograph models, which uses rainfall as the only input while runoff is the output. It is less popular than unit hydrographs because parameters must be determined by trial and error, requiring more mathematics. In this paper a method for efficiently calculating the three main model parameters is presented. Calculations of memory, order, and truncation can furthermore be programmed into the model to improve its efficiency. More work is needed to analyze the degree of nonlinearity of different watersheds to determine whether a nonlinear model is always better. (Titus-FRC)
W83-00654

DATA MANAGEMENT SYSTEM FOR URBAN HYDROLOGY STUDIES PROGRAM,
Geological Survey, NSTL Station, MS. Water Resources Div.
For primary bibliographic entry see Field 7C.
W83-00683

COMPUTER PROGRAMS FOR MODELING FLOW AND WATER QUALITY OF SURFACE WATER SYSTEMS,
Geological Survey, NSTL Station, MS. Water Resources Div.
J. A. Lorens.
Available from the OFSS, USGS Box 25425, Fed. Ctr. Denver, CO 80225, Price: $4.25 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 82-430, 1982. 62 p, 2 Tab, 1 Ref.

Descriptors: *Hydrologic models, Watersheds, *Streamflow, *Surface waters, *Water quality, Computer programs, Model studies.

A selection of available computer programs for modeling flow and water quality in surface water systems is described. The models include programs developed as part of the U.S. Geological Survey Water Resources Division hydrologic research activities and others developed by other agencies, universities, and consulting firms. Each model description includes a statement of program use; data requirements; computer costs; availability of documentation and reference material; and a contact person for additional information. The report is intended to assist the researcher by presenting a very brief description of the surface-water models which are readily available for project use. (USGS)
W83-00687

2C. Snow, Ice, and Frost

ENVIRONMENTAL ISOTOPE STUDIES OF AN ALPINE SNOWPACK,
Gesellschaft fuer Strahlenforschung m.b.H., Munich (Germany, F.R.). Inst. fuer Radiohydrometrie.
W. Stichler, W. Rauert, and J. Martinec.
Nordic Hydrology, Vol 12, No 4/5, p 297-308, 1981. 7 Fig, 2 Tab, 14 Ref.

Descriptors: *Snowpack, *Isotope studies, Snow accumulation, Snowmelt, Lysimeters, Hydrologic budget, Evaporation, Alpine regions, Snow cover, *Switzerland, Weissfluhjoch.

Mass exchange processes during the buildup and ablation of the snow cover and the hydrologic balance were studied at an experimental plot at Weissfluhjoch in Switzerland, which has an elevation of 2,540 meters above sea level. The environmental isotopes tritium, deuterium, and oxygen-18 were measured in samples taken from the precipitation, the snow cover, and meltwater from a snow lysimeter during the period 1971 through 1979. Varying isotope concentrations were found in the respective snow layers, indicating a mass exchange between the percolating melt water and the snow pack which influences the isotope composition of the outflow from the snow lysimeter. A correlation was found between the isotope concentrations in the snow cover and in the melt water. The enrichment of melt water in heavy stable isotopes in comparison with the snow cover and precipitation can be used to calculate the evaporation independently from hydrologic measurements. The tritium data also suggest a strong mass exchange by evaporation and condensation at the snow surface. (Carroll-FRC)
W83-00360

ACCURACY OF SNOWMELT RUNOFF SIMULATION,

National Aeronautics and Space Administration, Greenbelt, MD. Goddard Space Flight Center.
A. Rango, and J. Martinec.
Nordic Hydrology, Vol 12, No 4/5, p 265-274, 1981. 4 Fig, 3 Tab, 7 Ref.

Descriptors: *Snowmelt, *Mountains, *Runoff, Simulation analysis, Snow cover, Temperature, Precipitation, Performance evaluation, Data acquisition, Mathematical studies.

A snowmelt runoff model described earlier uses air temperature, snow coverage, and precipitation during the snowmelt period as essential input data for simulation analysis. The results of runoff simulations obtained by applying the model to various basins were analyzed in an effort to predict the accuracy of simulations in future applications of the model. This analysis demonstrated that the model can be applied to nearly any mountainous basin where snowmelt runoff is an important factor if the essential input data are available. The accuracy of the simulation will depend on the quality of the temperature, precipitation, and snow cover data as well as on the density of observations, the size of the basin, the care in determining the recession coefficient, and the amount of precipitation during snowmelt. The most accurate simulations will result when temperature and precipitation are recorded at the basin mean elevation; weekly snow cover observations are available; several climatic stations are available for large basins; and a few years of runoff records are available for the determination of the recession coefficient. Decreases in accuracy can be expected as these optimum conditions are compromised. However, even when climatological observations are not possible at multiple stations and when the recession coefficient must be estimated on the basis of a comparison of basin size with previously analyzed basins, acceptable simulations will result if temperature and precipitation data are available in the general vicinity of the basin and if snow cover observations are available two or three times during the snowmelt season. The availability of satellite observations of snow cover has enabled successful application of the simulation model to large basins. (Carroll-FRC)
W83-00370

ISOTOPE INPUT INTO RUNOFF SYSTEMS FROM MELTING SNOW COVERS,

Technische Univ., Brunswick (Germany, F.R.). Lehrstuhl fuer Physische, Geographie und Landschaftsokologie.
A. Herrmann, M. Lehrer, and W. Stichler.
Nordic Hydrology, Vol 12, No 4/5, p 309-318, 1981. 10 Fig, 8 Ref.

Descriptors: *Isotope studies, *Snowmelt, Runoff, Hydrographs, Hydrologic budget, Snow cover, Melting, *West Germany, Lainbach Creek basin.

The stable environmental isotopes deuterium and oxygen-18 are ideal tracers in the hydrologic cycle, suppling effective insight into basin runoff mechanisms and storage dynamics. Isotope techniques using these isotopes contribute to reasonable separations of the direct runoff component in snowmelt hydrographs. However, the real or actual isotope input values from the snow cover outflows are required for the separation procedure. Several cold room experiments with isotopically homogenous and stratified snow columns were conducted to study the effects of isotope fractionation and exchange processes in the snow cover on the isotopic outflow concentrations. The columns were treated with different heat supply and rainwater at the surface to simulate natural conditions. Outflows were analyzed for deuterium and oxygen-18 contents. Alterations of the melt intensities caused marked variations of the isotope contents of snowpack outflows. The difference between the deuterium contents of the surface layer, where the initial melt water is produced, and that of the outflows was very small. Hydrologic applications of the results to studies in the natural environment are discussed. (Carroll-FRC)
W83-00374

EFFECT OF SCALE ON THE COMPLEXITY OF SNOWMELT SYSTEMS,

Eidgenoessische Technische Hochschule, Zurich (Switzerland). Lab. of Hy draulics Hydrology and Glaciology.
L. N. Braun, and H. O. Slaymaker.
Nordic Hydrology, Vol 12, No 4/5, p 225-234, 1981. 8 Fig, 1 Tab, 11 Ref.

Descriptors: *Snowmelt, *Hydrologic budget, *Streamflow forecasting, Measurement techniques, Glaciers, Alpine regions, Watersheds, Prediction, Forecasting, *British Columbia, Miller Creek.

The value of using several spatial scales in the investigation of the interaction of atmospheric and hydrologic systems involved in snowmelt processes was evaluated. Studies of the nature of snow and ice storage, energy sources, and stream flow response were conducted during the melt season of 1978 at both a small scale watershed and a meso-scale watershed in the Pacific Coast Mountains of British Columbia, Canada. The release of meltwater at the base of the snowpack at the site scale was found to be a function of snow depth and density and of the timing of peak energy availability. At the small watershed scale, streamflow was primarily a function of snow phenology and variable runoff generation pathways. Streamflow at the meso-watershed scale was shown to be influenced primarily by snow and ice phenology, by the progressive development of englacial drainage systems, by the integrated response of individual tributaries draining slopes of varying aspects, and by lake and channel storage mechanisms. Different methods of analysis of snowmelt systems were also appropriate at the different scales. (Carroll-FRC)
W83-00375

MEASURING AND MODELLING SNOWMELT IN DYRDALEN, WESTERN NORWAY, 1979 AND 1980,

Bergen Univ. (Norway). Geofisisk Inst.
K. Harstveit.
Nordic Hydrology, Vol 12, No 4/5, p 235-246, 1981. 7 Fig, 5 Tab, 5 Ref.

Descriptors: *Snowmelt, *Measuring instruments, *Hydrologic budget, Energy, Mathematical models, Melting, Model studies, Prediction, Forecasting, *Norway, Dyrdalen.

Better models for predicting snowmelt are needed for use in such fields as hydroelectric power production and flood forecasting. A lysimeter was used to measure the runoff from a 9 square meter snowpack during the spring snowmelts in 1979 and 1980. Measurements of wind speed, air temperature, air humidity, radiation, and precipitation were also recorded. The melting rate and the net radiation values were used to compute the turbulent heat exchange between the snowpack and the atmosphere as a residual from the energy balance equation of the snowpack. These computed values were then used to find 'optimal' empirical constants in aerodynamic equations expressing the turbulent fluxes as functions of the wind speed and the temperature/vapor pressure differences between measurements 2 meters above the ground (0.6 to 1.5 meters above the snow surface) and the values at the surface. There was reasonable agreement between these values and the constants found by other researchers. The sensible heat flux represented 65% of the total energy consumed in melting during the two melting seasons, while net radiation represented 35%. Condensation and evaporation accounted for 13% of the energy lost and gained, respectively. Individual fluxes accounted for varying contributions to the melting from one day to another. The energy balance model yielded better results than the degree-day-model when weather conditions varied during the melting season. The simple degree-day-method gave good results only when there was no considerable variation in meteorological conditions during snowmelt. Snowmelt was about three times greater on overcast days than on days with light cloudiness, providing the wind and temperature conditions were the same and the albedo was about 70%. (Carroll-FRC)
W83-00376

MELTWATER HYDROLOGY AND HYDROCHEMISTRY IN SNOW- AND ICE-COVERED MOUNTAIN CATCHMENTS,

Victoria Univ. of Manchester (England). Dept. of Geography.
D. N. Collins, and G. J. Young.
Nordic Hydrology, Vol 12, No 4/5, p 319-334, 1981. 6 Fig, 2 Tab, 23 Ref.

Descriptors: *Snowmelt, *Conductivity, *Chemical composition, Dissolved solids, Watersheds, Alpine regions, Mountains, Glaciers, Water quality, Hydrology, Canada, Rocky Mountains, *Alberta, *British Columbia, Peyto Creek basin, Mistaya River basin.

Basic hydrological and hydrochemical data from two adjacent but contrasting alpine watersheds were compared in an effort to identify any distinctive features of snow- and ice-melt runoff patterns and to investigate the role of glacierization in alpine hydrochemistry. Electrical conductivity, a surrogate measure of total dissolved solids content, and meltwater discharges were recorded continuously in the two watersheds from mid-May through August, 1979. Solute concentration was found to vary inversely diurnally with discharge in both nival (seasonally snow-covered, but ice free) and glacial meltwaters. The snowmelt-fed Amiskwi River experienced a decline in solute content and discharge with decreasing availability of snow cover through July, followed by increased solute content during the low flows of August. Peyto Creek, which receives meltwater from a glacier, experienced decreased conductivity with increasing flow during the spring snow melt. However, conductivity oscillated daily through a limited range during the ice-melt domination of the flow from mid-July through August. These results demonstrated the contrasting roles of snowmelt and ice-melt in determining distinctive patterns of diurnal and seasonal temporal variations of discharge and hydrochemistry in mountain basins. Continuous monitoring of water quality is essential in characterizing the hydrochemistry of alpine environments. (Carroll-FRC)
W83-00377

APPLICATION OF THE GRAVITY FLOW THEORY TO THE PERCOLATION OF MELT WATER THROUGH FIRN,

Innsbruck Univ. (Austria). Inst. for Physical Medicine.
W. Ambach, M. Blumthaler, and P. Kirchlechner.
Journal of Glaciology, Vol 27, No 95, p 67-75, 1981. 5 Fig, 1 Tab, 14 Ref.

Descriptors: *Firn, *Snowmelt, *Percolation, *Gravity flow theory, Old snow, Glaciohydrology, Drainage, Snow, Glaciers.

The gravity flow theory was applied to the percolation of meltwater through the firn in the accumulation area of a temperate glacier to explain the occurrence of shock fronts in the meltwater flow. Since percolation velocity of meltwater increases with increasing flux, later, larger fluxes may catch up with smaller, earlier fluxes, forming a sudden increase in meltwater flux, known as a shock front. The time of propagation of a shock front moving from the surface through the firn was calculated. For example, for a firn 24 m deep and 2 peaks of meltwater input 12 hours apart, shock fronts were calculated at 77 and 101 hours at 24 m depth. Different time input functions of meltwater flux at the surface with constant total input volumes produced slight differences in terms of propagation of the shock front at greater depths. A nearly linear relationship was found between the time of propagation of a shock front moving through the firn and the total thickness of the firn. The drainage of meltwater from the firn after the summer ablation period was also described by the gravity flow theory. Observed lags in time between maximum meltwater inflow at the surface and the maximum flow at 24 m depth in the firn (50-100 hours) agreed well with calculated results. (Cassar-FRC)
W83-00513

FROZEN SOIL EFFECTS ON THE EROSION HAZARD,

Idaho Univ., Moscow. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 2J.
W83-00615

2D. Evaporation and Transpiration

EVAPOTRANSPIRATION AT TWO MOUNTAIN SITES DURING THE VEGETATION PERIOD,
Innsbruck Univ. (Austria). Inst. for Meteorology and Geophysics.
M. Staudinger, and H. Rott.
Nordic Hydrology, Vol 12, No 4/5, p 207-216, 1981. 4 Fig, 3 Tab, 4 Ref.

Descriptors: *Evapotranspiration, *Alpine regions, *Mountains, Energy, Precipitation, Solar radiation, Soil water, Vegetation, Diurnal variation, Radiation, *Austrian Alps.

The components of the surface energy balance and other meteorological parameters were measured at two test sites in the Austrian Alps in the months of July, August, and September of the years 1976 to 1978 and were used to calculate hourly, daily, and monthly evapotranspiration. One of the test sites was located at 1,960 meters above sea level, on a cultivated meadow slightly below the timberline, while the other was situated at 2,580 meters above sea level and was covered with alpine sedges and grasses. The calculated evapotranspiration values clearly demonstrate the decrease of evapotranspiration with altitude. Evapotranspiration was about 30% lower at the higher elevation for the vegetation periods considered, reflecting both the decrease of transpiring leaf areas and the increasing percentage of evaporation from soil with higher altitude. At the lower site, the amount of evaporation sometimes reached the order of total precipitation during the vegetation period. Net solar radiation was found to be the primary limiting factor for evapotranspiration at these Alpine sites. Diurnal variations of evapotranspiration followed the course of net radiation, indicating sufficient moisture supply. Plant transpiration diminished towards the end of the vegetation period, increasing the variability of the relation between net radiation and evapotranspiration to some degree and indicating some influence of precipitation on the amount of evapotranspiration. The high correlations found between the daily sums of net radiation and of evapotranspiration at both sites can be used for calculating evapotranspiration from radiation measurements. (Carroll-FRC)
W83-00352

IS EVAPORATION AN IMPORTANT COMPONENT IN HIGH ALPINE HYDROLOGY.
Eidgenoessische Technische Hochschule, Zurich (Switzerland).
H. Lang.
Nordic Hydrology, Vol 12, No 4/5, p 217-224, 1981. 3 Fig, 2 Tab, 15 Ref.

Descriptors: *Evaporation, *Alpine regions, *Hydrologic budget, Hydrology, Precipitation, Condensation, Glaciers, Snow cover, Ice cover, *Alps, Europe.

Evaporation in the high mountain areas of the European Alps is poorly understood. Current evaluations indicate that evaporation is a component of secondary importance in the water balance in these areas. The available mean areal evaporation data are based on conventional water balance estimates and suffer from inaccuracies in the determination of precipitation. Re searchers have reported rates of decrease in mean annual evaporation with altitude ranging from 71 millimeters t o 356 millimeters per 1,000 meters of altitide. Heat balance studies on glaciers demonstrate that evaporation/condensation is a process of high specific energy exchange, with the scale width of the latent heat flux of glaciers matching that of net radiation and being more than double the value of the sensible heat flux. Evaporation and condensation processes are important controlling factors in the time scale of the daily variations of the water balance in snow and ice areas under the existing climatic conditions in the Alps. (Carroll-FRC)
W83-00373

A COMPUTER SIMULATION OF THE EFFECTS OF DIFFERING CROP TYPES ON THE WATER BALANCE OF SMALL CATCHMENTS OVER LONG TIME PERIODS,
Leeds Univ. (England). School of Geography.
P. J. Sellers, and J. G. Lockwood.
Quarterly Journal of the Royal Meteorological Society, Vol 107, No 452, p 395-414, April, 1981. 14 Fig, 25 Ref.

Descriptors: *Interception loss, *Forest hydrology, *Hydrologic budget, Model studies, Pine trees, Grasslands, Hydrologic models, Runoff, Soil-water-plant relationships, Simulation analysis, Evaporation, Rainfall-runoff relationships, Transpiration, Trees.

A multilayer model (MANTA), suitable for tall crops, is used to simulate interception and evaporation of rainfall and transpiration loss for a pine forest. The most important improvement over the Rutter (1971) single layer model is the inclusion of a wetted area term, which allows more realistic modeling of the leaf's energy balance. However, the multilayer model has demanding data requirements. To overcome these difficulties, three submodels (standard meteorological site model, hydrological model, and multilayer model) are run together. Results of model runs suggest that the Rutter model substantially underestimates interception loss from low intensity rainstorms. Using a year's simulated meteorological data MANTA predicts an interception loss 20% greater than the Rutter estimate. Similarly, the interception losses predicted for pine forests are 4 times greater than for grassland. Predicted peak flows in grassland were 30% higher than in pine forests; total runoff in grasslands was twice as high as in pine. The MANTA results agree generally with experimental observations of other researchers on heat and vapor fluxes above wet and dry coniferous canopies. The effects of plant geometry on rate of interception loss are evident. (Cassar-FRC)
W83-00585

EVAPOTRANSPIRATION FROM RIPARIAN VEGETATION: WATER RELATIONS AND IRRECOVERABLE LOSSES FOR SALTCEDAR,
California Univ., Davis. Dept. of Land, Air and Water Resources.
For primary bibliographic entry see Field 3B.
W83-00663

EVAPOTRANSPIRATION FROM RIPARIAN VEGETATION: CONSERVING WATER BY REDUCING SALTCEDAR TRANSPIRATION,
California Univ., Davis. Dept. of Land, Air and Water Resources.
For primary bibliographic entry see Field 3B.
W83-00664

2E. Streamflow and Runoff

PROBABILITY OF ANNUAL FLOWS OF THE GREATER ZAB RIVER,
Clark (David) and Associates, Inc., Washington, DC.
F. El-Yussif.
Water Supply and Management, Vol 6, No 4, p 297-302, 1982. 9 Ref.

Descriptors: *River flow, *Flow characteristics, *Correlation analysis, Rainfall-runoff relationships, Greater Zab River, *Iraq, Runoff, Probabilistic process, Stochastic hydrology.

Annual flows for the Greater Zab River, Iraq, measured at one river station and 2 tributary stations, were analyzed for the years 1938-77. At Eski-kelek the average annual flow for this 40-year period was 13.461 cu km; minimum flow (1955), 8.672 cu km; and maximum flow (1969) 23.684 cu km. The flow series was stable according to analysis by the moving average technique. A cycle with a 15 year period was indicated. Rainfall-runoff relationships, studied with the lag cross correlation technique, showed that no significant cross correlation existed. (Cassar-FRC)
W83-00457

FLOW BENEATH A STAGNANT FILM ON WATER: THE REYNOLDS RIDGE,
Essex Univ., Colchester (England). Fluid Mechanics Research Inst.
For primary bibliographic entry see Field 8B.
W83-00516

LOW-FLOW CHARACTERISTICS OF OHIO STREAMS,
Geological Survey, Columbus, OH. Water Resources Div.
For primary bibliographic entry see Field 7C.
W83-00563

A RAPID, LOW-COST TECHNIQUE FOR ESTIMATING PEAK FLOW FOR SELECTED FLOOD EVENTS,
North Carolina Univ., Charlotte, Dept. of Geography and Earth Sciences.
N. R. Nunnally.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-125179, Price codes: A03 in paper copy, A01 in microfiche. Water Resources Research Institute Report No 180, North Carolina State University, Raleigh, May 1982. 31 p, 9 Fig, 3 Tab, 36 Ref, 1 Append. OWRT A-119-NC(1), 14-34-0001-1135.

Descriptors: *Streamflow forecasting, *Flood peak, *Flood flow, *Mathematical equations, *Urban watersheds, Economic aspects, Peak loads, Flood forecasting, Flood crest, Maximum probable floods, *North Carolina, Virginia, Flood profiles, Multivariate analysis, Urban hydrology, Mathematical models, Model studies, Long-term planning.

A regionalized streamflow estimation technique was developed for North Carolina and Virginia for estimating 2-, 10-, and 25-year return interval peak flows. Separate equations were generated for the mountain, piedmont, and coastal plain regions, and for urbanized watersheds. Comparison with previous techniques used in North Carolina indicated that the new equations produce more accurate peak discharge estimates in most instances. The technique was based on improved regression equations, obtained by confining the study to small watersheds, expanding the sample size (by using stream basins outside North Carolina), using longer data records and more variables which influence peak discharge, and controlling some of the data variance (by creating more homogeneous regions through the use of multivariate techniques). If return intervals, basin size, and lag are held constant, urban basins produce the largest discharge (followed by mountain, piedmont, and coastal plain). Equations developed for urban basins were the most accurate, overall. Peak discharge estimates for rural basins were improved, but U.S.G.S. equations gave slightly better results in some cases. (Zielinksi-MAXIMA)
W83-00613

INFILTRATION FORMULAS BY CURVE NUMBER PROCEDURE,
Geological Survey, NSTL Station, MS. Gulf Coast Hydroscience Center.
C.-L. Chen.
Journal of the Hydraulics Division, Proceedings of the American Society of Civil Engineers, Vol 108, No HY7, p 823-829, July, 1982. 1 Fig, 6 Ref.

Descriptors: *Infiltration, *Hydrologic budget, *Runoff, *Rainfall, *Mathematical studies, Infiltration rate, Watersheds, Algorithms, Depression storage, Interception, Precipitation, Hydrologic models, Rainfall intensity, Depth-area-duration analysis.

The Soil Conservation Service curve number procedure for estimating runoff volume is examined in terms of the validity and applicability of the de-

rived infiltration equations. The infiltration rate formula derived based on the hypothesis that potential maximum retention or infiltration includes the initial abstraction proves to be as general as, if not more general than, the Holtan-Overton equation. If the initial abstraction results mainly from infiltration that occurs before runoff begins, the amount of initial abstraction can be reasonably estimated from the derived infiltration rate formula, and the curve number procedure can be generalized without sacrificing its simplicity. The proposed method may not be valid for large watersheds where surface interception and depression storage dominate the initial abstraction. (Titus-FRC)
W83-00653

FLOOD DATA IN WEST WINDSOR TOWNSHIP, MERCER COUNTY, NEW JERSEY THROUGH 1981 WATER YEAR,
Geological Survey, Trenton, NJ. Water Resources Div.
For primary bibliographic entry see Field 7C.
W83-00690

ACOUSTIC SYSTEMS FOR THE MEASUREMENT OF STREAMFLOW,
Geological Survey, Portland, OR. Water Resources Div.
For primary bibliographic entry see Field 7B.
W83-00692

BACKGROUND HYDROLOGIC INFORMATION IN POTENTIAL LIGNITE MINING AREAS IN MISSISSIPPI, AUGUST 1981,
Geological Survey, Jackson, MS. Water Resources Div.
For primary bibliographic entry see Field 7C.
W83-00693

2F. Groundwater

PREDICTING DEPTHS TO THE WATER TABLE IN DEEPLY WEATHERED RIVER CATCHMENTS IN NIGERIA,
Ife Univ. (Nigeria). Dept. of Geography.
E. O. Omorinbola.
Journal of the Institution of Water Engineers and Scientists, Vol 36, No 3, p 191-204, May, 1982. 8 Fig, 8 Tab, 21 Ref.

Descriptors: *Prediction, *Water table profiles, *Groundwater level, *Nigeria, Catchments, Tropical regions, Observation wells, River basins, Spatial distribution, Temporal distribution, Regression analysis, Middle Osun Valley, Upper Oba Basin, Middle Owena Valley, Wells.

Depth to water table was studied in 3 major Nigerian river catchments, Middle Osun Valley, Upper Oba Basin, and Middle Owena Valley. The basins are Pre-Cambrian igneous and metamorphic rocks, chemically weathered by the tropical climate to average depths of 13-29 m. The main rivers have year-round flows and the tributaries, seasonal flows. Springs are rare. Mean annual rainfalls are 1480-1700 mm. Correlation coefficients were 0.92-0.96 for the 2 methods used to determine depth to water table: seismic refraction and observations of well water levels. Spatial and temporal variations of the water table level were determined from equations. In general, depths to the water table gradually increase to 10 m with distance from the river channel and can be predicted in advance of drilling. The maximum and minimum depths (3-4 m difference) to the water surface occur in February and July, respectively, for Osun and Oba, and January and July, respectively, for Owena. These findings can apply to similar catchments of the Basement Complex where the same environmental conditions prevail, such as areas of low-relief landscape, channels incised to bedrock, and regoliths with thick, widespread zones of saturation. (Cassar-FRC)
W83-00497

JANUARY 1981 WATER LEVELS, AND DATA RELATED TO WATER-LEVEL CHANGES, WESTERN AND SOUTH-CENTRAL KANSAS,
Geological Survey, Lawrence, KS. Water Resources Div.
For primary bibliographic entry see Field 7C.
W83-00553

HYDROLOGY AND CHEMICAL QUALITY OF GROUND WATER IN KIOWA COUNTY, COLORADO,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 7C.
W83-00561

DEEP OXYGENATED GROUND WATER: ANOMALY OR COMMON OCCURRENCE.,
Geological Survey, Reston, VA.
I. J. Winograd, and F. N. Robertson.
Science, Vol 216, No 4551, p 1227-1230, June 11, 1982. 2 Fig, 17 Ref.

Descriptors: *Groundwater, *Dissolved oxygen, *Aquifers, Groundwater dating, Recharge, Natural recharge, Groundwater recharge, Oxidation, Confined aquifers, Water properties, Chemical properties, Arid climates, Humid climates, *Nevada, *Arizona, *Arkansas, Hot springs, Appalachians.

The widespread presence of dissolved oxygen (DO) in significant concentrations (2-8 mg/l) is documented in water several thousand to > 10,000 years old from deep aquifers of several lithologies in arid and humid climates and at distances as great as 80 km from recharge areas. This evidence is contrary to the prevailing opinion that most DO in recharge water is consumed in the soil and unsaturated (or vadose) zones by the decomposition of organic matter and by microbial respi ration. Concentrations of 2-8 mg/l of DO were found in several aquifers in the south-central Great Basin, Nevada, where water table depths range from 200 to 1,000 m below the surface, the residence time of water is thousands to > 10,000 years, and at least one flow path is 80 km long. In the southern Arizona portion of the Basin and Range province, DO has been discovered in all shallow (< 100 m) and deep water from valley-fill aquifers. In many of these areas a clay stratum of > 100 m overlies the aquifer, preventing the mixing of deep water with shallow oxygenated groundwater. This water was estimated to be > 10,000 years old by C14 dating. Thermal spring waters in the Valley and Ridge Province from Georgia to New York and water in Hot Springs National Park, Arkansas have DO contents of 2-7 mg/l. Water temperatures are 30-60C, and flow paths from recharge to discharge areas are relatively short. H-3 data suggest that though the DO content of some of the hot springs may be a result of the mixing of deep thermal waters and shallow, cooler, younger ground water, several springs are of predominantly pre-H-bomb (1952) age. The presence of DO in the waters of Nevada and Arizona may be explained by the fact that valley-fill sediments were deposited under oxidizing conditions and probably remained exposed to oxidizing climates for tens to hundreds of years before burial; they then remained in oxidizing unsaturated zones for tens of thousands to hundreds of thousands of years. (Gish-FRC)
W83-00565

A CONDUCTIOMETRIC TECHNIQUE FOR MEASURING THE WATER VELOCITY IN SALMONID SPAWNING BEDS,
University of Wales Inst. of Science and Technology, Cardiff (England). Dept. of Applied Biology.
A. W. H. Turnpenny, and R. Williams.
Water Research, Vol 16, No 9, p 1383-1390, September, 1982. 7 Fig, 2 Tab, 12 Ref.

Descriptors: *Groundwater movement, Velocity, *Streambeds, *Standpipes, Remote sensing, Sampling, *Salmonids, Permeability, Gravel, *Spawning, *Conductiometric techniques, Fish, Measuring instruments, Fish eggs.

A modified standpipe technique has been developed to measure the groundwater velocity (also known as gravel permeability or apparent velocity) in salmonid spawning beds. This parameter is important because eggs of intragravel spawners and benthic invertebrates receive their oxygen supply from groundwater permeating through the gravel beds. An electrolyte, composed of 546 ml of 20 g per liter NaCl solution and 454 ml of pure ethanol, is placed in the standpipe. This arrangement allows conductivity changes and dilution rates to be determined by remote sensing. Since up to 8 standpipes may be operated in a spawning bed, systematic or randomized grid sampling designs may be used. Coefficients of variation were less than 8% for gravel permeabilities of 420-79,200 cm per hour and an average of 5% for apparent velocities of 11-239 cm per hour. (Cassar-FRC)
W83-00644

AVAILABILITY OF WATER FROM AQUIFERS IN UPSTATE NEW YORK,
Geological Survey, Albany, NY. Water Resources Div.
For primary bibliographic entry see Field 7C.
W83-00681

HYDROLOGIC DATA FROM TEST WELLS AND LOW-FLOW INVESTIGATIONS IN THE MIDDLE REACH OF THE EAGLE RIVER VALLEY, ALASKA, 1980-81,
Geological Survey, Anchorage, AK. Water Resources Div.
For primary bibliographic entry see Field 7C.
W83-00682

GROUND-WATER LEVELS IN SELECTED WELL FIELDS AND IN WEST-CENTRAL FLORIDA, SEPTEMBER 1981,
Geological Survey, Tampa, FL. Water Resources Div.
For primary bibliographic entry see Field 7C.
W83-00685

AQUIFER DATA FROM FOUR WELLS IN THE MENDENHALL VALLEY NEAR JUNEAU, ALASKA,
Geological Survey, Anchorage, AK. Water Resources Div.
For primary bibliographic entry see Field 7C.
W83-00686

REGIONAL GEOHYDROLOGY OF THE NORTHERN LOUISIAN SALT-DOME BASIN, PART I, CONCEPTUAL MODEL AND DATA NEEDS,
Geological Survey, Baton Rouge, LA. Water Resources Div.
G. N. Ryals.
Available from the OFSS, USGS Box 25425, Fed. Ctr. Denver, CO 80225, Price: $4.00 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 82-343, 1982. 23 p, 5 Fig, 2 Plates, 6 Tab, 25 Ref.

Descriptors: *Underground waste disposal, *Geohydrology, *Groundwater movement, *Path of pollutants, Model studies, Aquifer characteristics, Water quality, Surface-groundwater relationships, Radioactive waste disposal, Waste management, Water analysis, Potentiometric level, Radioactive analysis, *Louisana, Northern Louisana salt-dome basin.

As part of the National Waste Terminal Storage Program, the U.S. Geological Survey is conducting a regional study of the geohydrology of the northern Louisiana salt-dome basin and developing a regional multi-layered ground-water flow model to determine regional flow paths. In the salt-dome basin the Tokio Formation and Brownstown Marl (Austin aquifer in this report), and Nacatoch Sand of Late Cretaceous age and the Wilcox Group, Carrizo Sand, Sparta Sand, and Cockfield Formation of Tertiary age contain regional aquifers within the maximum potential repository depth of 3,000 feet. The Cretaceous units contain saltwater throughout the basin. The Tertiary units contain freshwater to varying distances downdip from outcrop areas in the basin. Natural flow directions and

rates of movement of groundwater have been changed in the salt-dome basin by the withdrawl of freshwater and by the injection of wastes (principally oil-field brines) into saline aquifers. Except for the Sparta aquifer, ground-water flow directions are not well known because of a lack of potentiometric data. A regional test-drilling program, to collect the data needed to document concepts of the flow system and to quantify inputs to the planned ground-water flow model, has been proposed. The Sparta aquifer is being modeled because data are available for the unit. As regional test drilling provides data on other units, will be added to the model developed for the Sparta aquifer. (USGS)
W83-00691

GROUND-WATER QUALITY IN EAST-CENTRAL IDAHO VALLEYS,
Geological Survey, Boise, ID. Water Resources Div.
For primary bibliographic entry see Field 7C.
W83-00694

GEOHYDROLOGY OF THE VALLEY-FILL AQUIFER IN THE CORTLAND-HOMER-PREBLE AREA, CORTLAND AND ONONDAGA COUNTIES, NEW YORK,
Geological Survey, Albany, NY. Water Resources Div.
For primary bibliographic entry see Field 7C.
W83-00697

GEOHYDROLOGY OF THE VALLEY-FILL AQUIFER IN THE SPROUT AND FISHKILL CREEKS AREA, DUTCHESS COUNTY, NEW YORK,
Geological Survey, Albany, NY. Water Resources Div.
For primary bibliographic entry see Field 7C.
W83-00698

GEOHYDROLOGY OF THE GLACIOLACUSTRINE AQUIFER IN THE FULTON AREA, OSWEGO COUNTY, NEW YORK,
Geological Survey, Albany, NY. Water Resources Div.
For primary bibliographic entry see Field 7C.
W83-00699

2G. Water In Soils

EMPIRICAL RELATIONS BETWEEN SOIL COMPONENTS AND WATER RETENTION AT 1/3 AND 15 ATMOSPHERES,
Department of Agriculture, Ottawa (Ontario). Land Resource Research Inst.
R. De Jong, and K. Loebel.
Canadian Journal of Soil Science, Vol 62, No 2, p 343-350, May, 1982. 5 Tab, 30 Ref.

Descriptors: *Soil properties, *Water management, Resources management, Moisture availability, Moisture profiles, Information systems, Data collections, Model studies.

Information available from Canada Soil Information System (CanSIS) for soil-water-modeling purposes was used in developing regression equations which relate physical and chemical soil components to water retention. Such equations can be used either to estimate soil-water-holding capacity or to model soil water characteristic curves, required by budget and physical models, respectively. Multiple linear regression procedures were used to relate particle size distribution, percent silt, and organic carbon content to the gravimetric soil water content at 1/3 atmosphere and 15 atmosphere tensions, determined on disturbed samples. Some of the discrepancies encountered between predicted and observed values could be attributed to the mineralogical and/or textural distribution of the prediction vs. test data, but in other cases causes of inconsistency were unclear. The equations which were not tested due to insufficient available test data should be used with caution. (Baker-FRC)
W83-00415

2H. Lakes

BIOLOGY, METABOLISM AND FUNCTIONS OF LITTORAL SUBMERSED WEEDBEDS OF LAKE WINGRA, WISCONSIN, USA: A SUMMARY AND REVIEW,
Wisconsin Univ.-Madison. Dept. of Botany.
M. S. Adams, and R. T. Prentki.
Archiv fur Hydrobiologie Supplement, Vol 62, No 3/4, p 333-409, April, 1982. 15 Fig, 3 Tab, 119 Ref.

Descriptors: *Nutrients, *Aquatic plants, *Sediments, Lakes, Macrophytes, *Littoral zone, *Lake Wingra, *Wisconsin, Phytoplankton, Algae, Eutrophic lakes, Phosphorus, Nitrogen, Biomass, Seasonal variation, Productivity, Photosynthesis, Anaerobic conditions, Methane, Organic carbon, Population dynamics, Cycling nutrients.

Over 10 years of investigations of the macrophyte biology, metabolism, and function of the littoral zone of the 137 ha scenescent, eutrophic Lake Wingra, Wisconsin are summarized. Research concentrated on (1) productivity and biomass of submerged weedbeds, (2) physiological ecology of important species, (3) macrophytenutrient interactions, and (4) the role of littoral weedbeds in processing and exporting organic matter and nutrients. Myriophyllum spicatum became dominant in 1966 and declined rapidly by 1977. Competition between M. spicatum and the native Vallisneria americana indicated that Vallisneria is a summer specialist, adversely affected by decreased water transparency. M. spicatum forms dense canopies and stores carbohydrates in roots, permitting overwintering and early spring growth. Epiphyton were predominantly diatoms and other non-mat-forming algae, with the exception of Oedogonium, which formed dense mats near storm sewer outfalls. Macrophyte decomposition rate was high, producing large amounts of dissolved organic matter and nutrients. Anaerobic decomposition produced 700,000 moles of methane, 92% coming from the weedbed sediments. M. spicatum obtained 73% of tissue P from sediments by root uptake, mostly in fall. At times, the P level was lower than the critical concentration affecting photosynthesis rates. On decomposition of the plant, P was sloughed off or leached. Net transport of BOD, dissolved inorganic and organic P, dissolved organic carbon, and dissolved organic nitrogen was always from the littoral zone to the pelagic zone. The exported nutrients were largely derived from the macrophyte autolysis and decay. In this lake primary production was 430 g C per sq m per year (70%) from phytoplankton and 182 g C per sq m per year (30%) from macrophyte-epiphyton. Storm water runoff generally moved directly to the pelagic zone. (Cassar-FRC)
W83-00351

PHYSICAL AND CHEMICAL FEATURES OF PLAYA LAKES IN SOUTHEASTERN CALIFORNIA, USA,
Arizona State Univ., Tempe. Dept. of Zoology.
D. M. Kubly.
Archiv fur Hydrobiologie, Supplement, Vol 62, No 3/4, p 491-525, April, 1982. 3 Fig, 6 Tab, 79 Ref.

Descriptors: *Playas, *Saline lakes, *Geochemistry, Semiarid lands, Arid lands, Closed lakes, Lakes, Salinity, Chemical composition, Turbidity, Organic matter, Anions, Cations, Ephemeral lakes, Shallow water, Dry lakes, *California, Deserts, Phosphorus, Evaporation, Crystallization, Bicarbonates, Carbonates, Calcium, Magnesium, Sodium, Chlorides, Sulfates, Water quality.

Playas, or dry lakes, in southeast California were studied during 3 field trips in the winter and spring of 1978 and spring of 1979. Climate is hot and dry with temperatures up to 56C, highly variable precipitation, and low relative humidity. Characterist ic of the 40 lakes surveyed were -80m to 1600m altitude, 2.3 to 29,020 ha (most smaller than 1000 ha) area, 100 to 325,000 ppm salinity, 96 to 338,064 ppm total dissolved solids, 5.8 to 13.8 ppm dissolved oxygen, 5 to 21,050 JTU turbidity, 7.5 to 10.0 pH, 0.11 to 73.31 ppm phosphate, and 3.4 to 534.6 ppm Si02. Most lakes were elliptical and contained shallow, well-mixed waters overlying level bottoms. Ratios of water volume to sediment area were extremely low. Thermal stratification and oxygen depletion were not observed. Na was the dominant cation in all but 1 lake. Its dominance was attributed to fractional dissolution of efflorescent salts and cation excha nge on clay minerals, rather than evaporation-crystallization. Low salinity lakes generally contained sodium car bonate-bicarbonate water. As total dissolved solids increased, Cl and sulfate concentrations increased. Some waters were nearly pure chloride brines. Principal component analysis showed a transition from very turbid, dilute lakes with high organic matter to lo w turbidity, higher saline lakes with low organic matter. Principal component analysis also divided the 7 most saline lakes into 2 groups: (1) high pH, total alkalinity, silica, and total P, with much of the Ca and Mg already precipitated and (2) lower pH, total alkalinity, silica, total P, with an excess of dissolved Ca and Mg over carbonate/bicarbonate. These groupings were a result of the differences in bicarbonate/Ca + Mg mole ratios of inflowing waters, which determined different evaporation-crystallization pathways. (Cassar-FRC)
W83-00372

ASSESSING BIOMASS AND PRODUCTION OF BACTERIA IN EUTROPHIC LAKE MENDOTA, WISCONSIN,
Wisconsin Univ.-Madison. Dept. of Bacteriology.
C. Pedros-Alio, and T. D. Brock.
Applied and Environmental Microbiology, Vol 44, No 1, p 203-218, July, 1982. 10 Fig, 4 Tab, 53 Ref.

Descriptors: *Eutrophic lakes, *Bacteria, Sedimentation, *Lake sediments, Sediments, Zooplankton, Productivity, Biomass, *Wisconsin, *Lake Mendota, *Eutrophication, Primary productivity.

Estimates were made of bacterial biomass and production in a eutrophic lake using recently developed techniques. Cell counts in the epilimnion of Lake Mendota, Wisconsin were done with epifluorescence microscopy and varied from 300,000 bacteria per ml in winter to 3,000,000 bacteria ml in summer. Cell volumes were measured using scanning electron micographs. Annual variations and depth distribution were studied. Production was estimated from the frequency of dividing cells and from dark radioactive sulfate uptake. Annual productivity and daily average productivity were very close with both methods: 107 to 205 g of C square m per year for sulfate and 89 to 117 g of C per square m per year for frequency of dividing cells. Zooplankton feeding removed 2 to 10% of the bacterial net production annually. When compared with biomass changes and losses due to zooplankton feeding, production values were very high. Thus it was concluded that other loss factors have to be more important than zooplankton feeding in controlling the bacterial population. Bacterial heterotrophic production was about 50% of gross primary production. It is suggested that a considerable proportion of the bacterial production is locked into particles and sediments with them to the hypolimnion and eventually to the bottom of the lake. (Baker-FRC)
W83-00384

PRIMARY PRODUCTIVITY AND NUTRIENT BALANCE IN A LOWER COLORADO RIVER RESERVOIR,
Department of Scientific and Industrial Research, Taupo (New Zealand). Freshwater Section.
J. C. Priscu, J. Verduin, and J. E. Deacon.
Archiv fur Hydrobiologie, Vol 94, No 1, p 1-23, April, 1982. 12 Fig, 3 Tab, 36 Ref.

Descriptors: Productivity, *Phytoplankton, *Nutrients, Lakes, Reservoirs, Hypolimnion, Flow pattern, *Primary productivity, Stratification, Thermal stratification, Nitrogen, Phosphorus, *Lake Mohave, Lake Mead, Hoover Dam, Davis Dam, *Colorado River.

Primary productivity of phytoplankton was studied at 4 sites in Lake Mohave, a reservoir on the Colorado River, and at one site on the Colorado River upstream of the reservoir. Sampling was

done from October 1976 to September 1977. Lake Mohave, impounded by Davis Dam, receives its water from a 61 m depth (hypolimnion) in Lake Mead. In flows from this source, rich in dissolved N and P, and low in phytoplankton, are highly variable in time and volume. During thermal stratification the Colorado River water flows under the Lake Mohave epilimnion. At this time productivity averaged 3474 mg C per sq m per day just beneath the underflow. Here the peaks of phytoplankton biomass were significantly correlated with large Hoover Dam discharges about a month earlier. Productivity in the rest of the reservoir averaged 1700 mg C per sq m per day. Less than 5% of the nutrients (19,370 kg total N per day and 725 kg total P per day) were retained in the reservoir. (Cassar-FRC)
W83-00394

DISSOLVED HUMIC MATERIALS: PHOTODEGRADATION, SEDIMENT EFFECTS, AND REACTIVITY WITH PHOSPHATE AND CALCIUM CARBONATE PRECIPITATION,
Oak Ridge National Lab., TN.
A. J. Stewart, and R. G. Wetzel.
Archiv fur Hydrobiologie, Vol 92, No 3, p 265-286, October, 1981. 12 Fig, 2 Tab, 33 Ref.

Descriptors: *Phosphates, *Humic acids, *Degradation, Nutrients, Calcium carbonate, Algae, Fulvic acids, Organic matter, Lakes, Photodegradation, Sediments, Lake sediments, Hydrogen ion concentration, Intertidal areas, Light intensity, Littoral environment, Lawrence Lake, *Michigan.

The relative importance of photolysis, sediment type and pH in regulating the quality and quantity of dissolved humic materials (DHM) was determimed in a small hard water lake, Lawrence Lake, Michigan. The relationships between DHM-orthophosphate and DHM-calcium carbonate precipitation were also examined. Fluorescing components of humic substances from 5 sources, purified and natural, were degraded by ultraviolet light to 50% of initial values within 2-95 min. These substances in the Lawrence water sample were completely degraded within 16 min. Full natural sunlight exposure also degraded humic materials. Photolysis was faster in younger DHM and in lower molecular weight DHM. Therefore, sunlight can be an important factor in regulating DHM in shallow littoral zones and in the photic zone. Under basic conditions organic-rich sediments absorbed DHM of high molecular weight leaching from vegetation during rain events and slowly released lower molecular weight DHM between rain events. In the sphagnum sediments at lower pH, DHM of high molecular weight was released more rapidly than DHM of lower molecular weight and was strongly adsorbed by the Lawrence Lake inlet sediments. Binding of DHM to orthophosphate was not demonstrated under conditions similar to those in the epilimnion of Lawrence Lake. However, in more acid lakes orthophosphate-DHM binding may be an important factor in regulating the availability of orthophospahte. Low concentrations (< 2 mg per liter) of fulvic substances inhibited the calcium carbonate precipitation by algae under ambient conditions. C14 assimilation was not significantly changed in the short-term experiments (up to 3 days). Thus intensive rainstorms, washing DHM into the pelagic zone, could make more phosphate available by retarding coprecipitation with Ca. (Cassar-FRC)
W83-00397

MICROBIAL COMMUNITIES IN LAKE PLUSSEE--AN ANALYSIS WITH NUMERICAL TAXONOMY OF ISOLATES,
Max-Planck-Inst. fuer Limnologie zu Ploen (Germany, F.R.).
K.-P. Witzel, H. J. Overbeck, and K. Moaledj.
Archiv fur Hydrobiologie, Vol 94, No 1, p 38-52, April, 1982. 4 Fig, 1 Tab, 43 Ref.

Descriptors: *Bacteria, *Seasonal variation, *Taxonomy, Lakes, Lake Plussee, *West Germany, Microorganisms, Cluster analysis, Eutrophic lakes.

One hundred twenty-four bacterial strains were isolated from water samples collected from eutrophic Lake Plussee, Germany, June 1967 to September 1968 at depths of 1 to 7 m. Analysis of each isolate for 105 biochemical, cultural, morphological, and physiological characteristics and application of cluster analysis produced a set of 9 clusters comprising 3-35 strains each from 108 of the strains. Besides a core of bacterial strains present at all seasons and depths there were specialized components appearing under special environmental conditions. In winter only the core strains were present. Additional clusters were present in spring, summer, and autumn. Some clusters were also common to both spring and summer. (Cassar-FRC)
W83-00399

TRACE METAL SPECIATION IN THREE VICTORIAN LAKES,
Caulfield Inst. of Tech. (Australia). Dept. of Chemistry.
For primary bibliographic entry see Field 5A.
W83-00412

AN INDEX OF LITTORAL ZONE COMPLEXITY AND ITS MEASUREMENT,
Toronto Univ. (Ontario). Dept. of Zoology.
C. Kent, and J. Wong.
Canadian Journal of Fisheries and Aquatic Sciences, Vol 39, No 6, p 847-853, June, 1982. 6 Fig, 3 Tab, 18 Ref.

Descriptors: *Lake morphology, *Littoral zone, *Shores, Fractal equations, Geomorphology, Maps, Lake shores, Physical properties, *Ontario, Canadian Shield.

Shoreline length and littoral area were accurately characterized by computer digitization of maps of 8 lakes in the Canadian Shield in Ontario. Map scales varied from 1:25,000 to 1:500,000. Patterns in lake shoreline lengths drawn from maps of different scales were described and found to hold for many different lakes in the same geological province. By considering at least 2 different geomorphological processes which form a lake shoreline, it was possible to extrapolate shore lengths from large to fine-scale measurements without losing accuracy. The fractal measuring theory explained the empirical results and allowed predictions about statistical properties of groups of lakes, such as the relationship between lake area vs. shoreline length. For the lakes under study the value of D in Korchak's law (the shoreline development index, or degree of shoreline convolution) was 1.51, in agreement with measured results. Fractal indexes may be useful in explaining lake biological community structure, littoral productivity, erosional processes, and landforms. (Cassar-FRC)
W83-00414

THE EUTROPHICATION OF CAYUGA LAKE: A HISTORICAL ANALYSIS OF THE PHYTOPLANKTON'S RESPONSE TO PHOSPHATE DETERGENTS,
Massachusetts Univ., Amherst. Water Resources Research Center.
For primary bibliographic entry see Field 5C.
W83-00509

THE INFLUENCE OF RIVER FLOW ON PELAGIC SARDINE CATCHES IN LAKE KARIBA,
Lake Kariba Fisheries Research Inst. (Zimbabwe).
B. E. Marshall.
Journal of Fish Biology, Vol 20, No 4, p 465-469, April, 1981. 2 Fig, 3 Tab, 15 Ref.

Descriptors: *Fish farming, *Nutrient requirements, Lakes, Africa, Lake Kariba, Zambezi River, Rivers, Nutrients, Sardines, Rainfall, Flooding, Fisheries, *Zimbabwe.

Nutrient levels were examined in Lake Kariba, a man-made lake on the Zambezi river. It has a very large outflow in relation to its volume. The Zambezi is the most important river flowing into the lake and provides about 70% of the lake's water. Two other tributaries, the Gwaai and the Sanyati, supply about 10%, and 7% comes from direct rainfall on the lake surface. The flow of the rivers is seasonal, and they flood during the rainy season from November to February. The Zambezi has a relatively low nutrient level compared to other African rivers. The other tributaries are richer in nutrients and have an appreciable local effect on sardine catches in the lake. This is shown by increased catches of Limnothrissa miodon after strong flows have occurred in the Sanyati river. No such correlation has been found between sardine catches and flow from the Zambezi River. Thus prolonged periods of poor rainfall could have a major impact on the sardine fishery and climatic conditions are a factor that must be considered in planning management policies for sardine farms. (Baker-FRC)
W83-00518

SEASONAL AND SPATIAL DISTRIBUTION OF HUMUS FRACTIONS IN A CHAIN OF POLYHUMIC LAKES IN SOUTHERN FINLAND,
Helsinki Univ. (Finland). Dept. of Limnology.
V. Pennanen.
Hydrobiologia, Vol 86, No 1/2. p 73-80, January, 1982. 4 Fig, 3 Tab, 28 Ref.

Descriptors: *Humic acids, *Colloids, *Stratification, Lakes, *Finland, Lake Hakojarvi, Gels, Filtration, Organic matter, Particulate matter.

Water from humic lakes in the Kokemaenjoki catchment, Finland, was fractionated on Sephadex G-100 columns. The method produced four fractions: f1, fast eluting, large molecules; f2 slow eluting, small molecules; fo, the fraction between f1 and f2; and fx, the particulate fraction retained on the column and otherwise lost during elution. Fractions fx (particulate) and f1 (colloidal) showed very weak fluorescence, high light scattering, and high total iron levels. Fractions fo and f2, dissolved, showed no light scattering, moderate fluorescence, and occasional iron content. Organic carbon levels were high in f2, noticeable in f1 and fo, and uncertain in fx. Fractions fo and f2 were uniformly distributed in the water column, and fx and f1 were regularly stratified. Seasonal variation of the fx and f1 fractions varied strongly both temporarily and spatially in 3 groups of samples: (1) terrestrially-influenced, (2) 1-9 m layer of Lake Hakojarvi, and (3) 15-16 m (near bottom) layer of Lake Hakojarvi. (Cassar-FRC)
W83-00521

CARBON, PHOSPHORUS AND NITROGEN BUDGETS OF THE LITTORAL EQUISETUM BELT IN AN OLIGOTROPHIC LAKE,
Tvarminne Zoological Station (Finland).
J. Sarvala, T. Kairesalo, I. Koskimies, A. Lehtovaara, and J. Ruuhijarvi.
Hydrobiologia, Vol 86, No 1/2, p 41-53, January, 1982. 3 Fig, 2 Tab, 49 Ref.

Descriptors: *Nutrients, *Littoral zone, *Macrophytes, Carbon, Nitrogen, Phosphorus, Oligotrophic lakes, Lakes, Lake Paajarvi, *Finland, Sediments, Zooplankton, Phytoplankton, Benthic fauna, Fish, Equisetum, Aquatic plants, Cycling nutrients, Productivity.

The role of the littoral macrophyte, Equisetum, in the carbon, phosphorus, and nitrogen budgets of an oligotrophic, mesohumic lake was studied in Lake Paajarvi, Finland, during 1979-80. Through all seasons the major store for organic C, N, and P was the sediments. The second most important reservoir of these materials, and the most important living component, was the Equisetum. In spring only the dead remains of the macrophyte were present above ground. Nutrient, chlorophyll a, and zooplankton concentrations were similar in the littoral area and in the open lake; phytoplankton and epiphytes were the major producers. By early June new Equisetum shoots had reached the surface, and water exchange between the littoral zone and open lake started to decrease. By August phosphorus, chlorophyll a, and zooplankton concentrations in the macrophyte stand were 5-10 times higher than in the open lake. Equisetum dominated biomass and production from late June until autumn, with a peak in August. At this time C and nutrient stores were 100 times those of the other living components and 30-50 times higher than the total

C and nutrient contents of water. The rate of internal cycling of carbon and nutrients was high. P was the limiting nutrient, as suggested by the high N:P ratios. The annual production of Equisetum contained 2.3% of the mean annual P load and 5.3% of the mean total P storage in the water volume of the lake. Figures gave the C, P, and N distribution in the main components of the littoral ecosystem. (Cassar-FRC)
W83-00522

ESTABLISHING THE PATTERN OF HETEROTROPHIC BACTERIAL ACTIVITY IN THREE CENTRAL AMAZONIAN LAKES,
Max-Planck-Inst. fuer Limnologie zu Ploen (Germany, F.R.).
H. Rai, and G. Hill.
Hydrobiologia, Vol 86, No 1/2, p 121-126, January, 1982. 4 Fig, 13 Ref.

Descriptors: *Bacteria, *Seasonal variation, *Trophic level, Lakes, Amazon, Heterotrophic bacteria, Primary productivity, Chlorophyll a, Nutrients, Nitrates, Phosphates, Water level fluctuations, Lake Janauari, Lake Cristalino, Lake Tupe, Algal growth, Productivity, Floating plants, *Brazil.

Seasonal trends in heterotrophic activity (Vmax) were studied in 3 central Amazonian lakes. Lago Janauari, a 79 ha mixed water Ria/Varzea lake, supports the growth of floating meadows composed of Paspalum repens and Echinochloa polystachya. Lago Cristalino (24 ha) and Lago Tupe (68 ha) are black water lakes. Water levels, nutrient concentrations, and chlorophyll a levels all controlled heterotrophic activity, which varied greatly from ologotrophic to eutrophic and back to oligotrophic over the course of a year. In January the decomposition of floating plant meadows was the regulating factor in heterotrophic activity. The plants, which started to decompose and release carbon during low water levels in January, produced a sharp rise in Vmax to a peak of 312 micrograms glucose per liter per hour in the water column. Minimum Vmax (nearly zero) was in the early part of the dry season (July-September). In Cristalino the natural substrate caused Vmax to fluctuate from 0.04 micrograms per liter per hour at the surface in July to 9.64 micrograms per liter per hour in October. In October total bacterial densities were 112 million per liter, of which only 0.17% were saprobic bacteria. From May to October there was a positive relation between Vmax and phosphorus. In Tupe Vmax at the surface (0.09 to 9.3 micrograms glucose per liter per hour) was controlled by algal growth. As algae died off, releasing glucose, Vmax increased to a major peak in December and a minor peak in September. Nitrates, phosphates, and water levels, in turn, controlled algal growth. (Cassar-FRC)
W83-00523

NUTRIENT DEPENDENCE OF PHYTOPLANKTON PRODUCTION IN BROWN-WATER LAKES WITH SPECIAL REFERENCE TO LAKE PAIJANNE,
Hydrobiolofical Research Inst., Jyvaskyla Univ. (Finland).
For primary bibliographic entry see Field 5C.
W83-00524

LIMNOLOGICAL RESEARCH CAN IMPROVE AND REDUCE THE COST OF MONITORING AND CONTROL OF WATER QUALITY,
Uppsala Univ. (Sweden). Inst. of Limnology.
For primary bibliographic entry see Field 5G.
W83-00526

THE ANNUAL FLOOD REGIME AS A REGULATORY MECHANISM FOR PHYTOPLANKTON PRODUCTION IN KAINJI LAKE, NIGERIA,
Outokumpu Oy, Kokkola (Finland). Kokkola Works.
S.-G. Karlman.
Hydrobiologia, Vol 86, No 1/2, p 93-97, January, 1982. 4 Fig, 18 Ref.

Descriptors: *Phytoplankton, *Productivity, *Turbidity, Lakes, Lake Kainji, *Nigeria, Primary productivity, Light penetration, Seasonal variation, Floods, Tropical regions, Optical properties, Transparency.

Phytoplankton production in Kainju Lake, Nigeria, was affected by the annual flood pattern: the black flood, a clear water flood rising from August or September and peaking in January-February, and the white flood, a flow of local-origin turbid water peaking in August-September. This lake has a flow-through ratio of 4:1, giving it the character of a wide slow-flowing river. Production was measured in situ from December 1970 to September 1972. Oxygen production was 220-4500 mg 02 per sq m per day. During the white flood light transparency was low (1% light attenuation at less than 1 m) and phytoplankton production was correspondingly low. In April-July phytoplankton production was highest, correlating with high transparencies (1% transmission at about 7 m). (Cassar-FRC)
W83-00529

THE EFFECT OF LAND USE ON THE DIATOM COMMUNITIES IN LAKES,
Joensuu Univ. (Finland). Karelian Inst.
For primary bibliographic entry see Field 5C.
W83-00530

CONVECTION IN BOTTOM SEDIMENTS AND ITS ROLE IN MATERIAL EXCHANGE BETWEEN WATER AND SEDIMENTS,
Water Protection Association of Savo, Kuopio (Finland).
For primary bibliographic entry see Field 5B.
W83-00531

THE SEASONAL CYCLE OF INORGANIC CARBON SPECIES IN CAZENOVIA LAKE, NEW YORK, 1977,
Syracuse Univ., NY. Dept. of Civil Engineering.
S. W. Effler, S. D. Field, and M. Quirk.
Freshwater Biology, Vol 12, No 2, p 139-147, April, 1982. 6 Fig, 20 Ref.

Descriptors: *Carbon cycle, *Lakes, *Seasonal variations, Metabolism, *Cazenovia Lake, *New York, Carbon dioxide, Carbonates, Chemical reactions, Hypolimnion, Carbon, Thermal stratification, Stratification, Epilimnion, Littoral zone.

The spatial and temporal distributions of inorganic carbon and related forms were determined for Cazenovia Lake, New York, to evaluate the sensitivity of the carbonate system to biological and physical processes. Cazenovia Lake is a small shallow lake, located in Central New York State. The lake is mostly spring fed, moderately rich in inorganic carbon, and subject to very little cultural influence. Samples were collected weekly for 1 year, from one pelagic and two widely separated littoral sites on the lake. The carbonate chemistry results for Cazenovia Lake depict temporal and spatial trends that are in general agreement with those described for other hardwater systems. During summer stratification the epilimnion is rich in light compared to the hypolimnion. Photosynthesis consumes carbon dioxide in the upper waters, resulting in reduced H2C03, increased pH and carbonate ions and thus an increased degree of calcium carbonate saturation. Usually less photosynthesis and more respiration and biochemical oxidation occur in the light-poor hypolimnion. During winter ice-covers, the entire lake is light poor and behaves similarly to the hypolimnion during summer stratification. Photosynthesis is limited to the uppermost layers, and mixing is very limited. Analysis of potentially influencing factors indicates that the seasonal trends were mostly a result of carbon dioxide metabolism. (Baker-FRC)
W83-00532

THE PALAEOLIMNOLOGY OF LAKE MYVATN, NORTHERN ICELAND; PLANT AND ANIMAL MICROFOSSILS IN THE SEDIMENT,
Iceland Univ., Reykjavik. Inst. of Biology.
A. Einarsson.
Freshwater Biology, Vol 12, No 1, p 63-82, February, 1982. 5 Fig, 1 Tab, 70 Ref.

Descriptors: *Paleolimnology, *Cold regions, Lakes, Limnology, *Iceland, Algal growth, Lake Myvatn, Ecosystems, Microbiological studies, Cladophora, Chlorophyta, Algae, Lake sediments.

Paleolimnological evidence is presented for the existence of Lake Myvatn I. The lake is divided into three basins on physical, chemical and biological grounds: the Sydrifloi, Ytrifloi and Bolir basins. Myvatn lies between two north-south trending fissure swarms. The eastern fissure swarm has been very active in the vicinity of Myvatn, and postglacial lava fields of different ages form the bedrock of the lake basins. The sediment of the lake is pure diatomaceous gyttja, is mostly between 3 and 6 meters thick and is relatively homogeneous in the Ytrifloi basin. In the Sydrifloi basin the gyttja is replaced by a very sandy layer of unknown origin at the 3-6 meter region in certain localities. The succession of diatoms within sediment cores can be divided into four zones with the first from 0-187 cm, second from 187-225 cm, third from 225-240 cm, and fourth from 240-285 cm. Numerous pseudocraters in the vicinity are of several types, giving evidence of the prehistory of the lake. Most of the craters are of the platform type. Crater cones are made usually of coarse scoria, sometimes of spatter. The diatom flora was identical in almost all the craters investigated. At 90 cm deep (around 1600 AD) in the Sydrifloi sediment a simultaneous increase occurred in Cladophora aegagropila (Chlorophyta), Eurycerus lamellatus (Cladocera) and three diatom species epiphytic on Cladophora. The increase in Cladophora may have been caused by improved light conditions on the bottom, either because of a decrease in water depth due to sedimentation, or a decrease in Anabaena blooms or both. (Baker-FRC)
W83-00533

GRAFHAM WATER: A DISCUSSION OF LIMNOLOGICAL EVENTS DURING THE 5-YEAR PERIOD 1974-1978,
Anglian Water Authority (England).
R. F. Stent.
Freshwater Biology, Vol 11, No 6, p 567-578, December, 1981. 5 Fig, 5 Tab, 17 Ref.

Descriptors: *Algal growth, *Reservoirs, *Grafham Water, *England, Algae, Nutrients, Seasonal variation, Wind, Temperature effects, Drought, Reservoir operation.

In the period between 1974-78, the diversity of the algal population in Grafham Water, a lowland reservoir, appeared to have diminished somewhat. At least a few successful species have dominated the lake for periods of the year, while numbers of once-abundant forms have dropped. This may be partly due to the massive inflow of nutrients and unusual conditions following the drought of 1976. The lake is now returning to former conditions with a drop in nutrient concentrations, including nitrate. It seems probable that algal nutrient levels will soon fall to their pre-drought levels unless abnormal conditions intervene. Future algal events affecting reservoir management and treatment may be asmuch controlled by climatic events as by nutrient concentrations. The effects of weather, particularly radiation and wind, on algae may be of equal importance to nutrient levels in Grafham and will be investigated. (Baker-FRC)
W83-00534

CHANGES IN SUBMERSED MACROPHYTES IN CHAUTAUQUA LAKE, 1937-1975,
North Dakota Univ., Grand Forks.
S. A. Nicholson.
Freshwater Biology, Vol 11, No 6, p 523-530, December, 1981. 1 Fig, 3 Tab, 31 Ref.

Descriptors: *Lakes, *Macrophytes, Potamogeton, Myriophyllum, *Chautauqua Lake, *New York, Eutrophication, Phytoplankton, Algal growth, Eutrophic lakes.

Changes in macrophyte richness, relative abundances, depth distributions and dominant species were assessed from the period of 1937 to 1975 in the eutrophic lake Chautauqua, located in western New York. The lake is of natural origin and has

two basins, a northern basin of 2856 ha, 7.8 meters in depth and 23 meters in maximum depth, and a southern basin of 2468 ha, 3.5 meters and 6 meters respectively. The north basin stratifies in deep spots at 7-9 meters, but the south basin does not stratify due to its shallowness. Eight factors could have contributed to changes in macrophyte communities from the 1930's, including climate, eutrophication, sedimentation, phytoplankton, attached algae, fish, zooplankton, and macrophyte management practices. Thirty-two macrophytes were recorded in 1972-75, as compared with 24 in 1937. The floras were quite similar, having nineteen species in common for a Sorenson index of 0.83. Many species exhibited notable changes in relative abundance from 1937 to 1972-75, mostly declines. As with species richness, declines were concentrated in the Potamogetonaceae, in which 10 of the original 15 species declined, 7 markedly so. A comparison of depth ranges occupied by species in 1937 and 1972-75 revealed only occasional deviations. Depth distributions of three newly recorded species, E. nuttallii, N. guadalupensis, and R. trichophyllous, were similar to those of their cogeners in 1937. The data suggest that no major changes in light regime have occurred and therefore no major increase in phytoplankton density such as would result from increasing eutrophication. (Baker-FRC)
W83-00535

COMPARISON BETWEEN THE CARBON-14 AND OXYGEN CONSUMPTION METHOD FOR THE DETERMINATION OF THE ACTIVITY OF HETEROTROPHIC BACTERIAL POPULATIONS,
Delta Inst. of Hydrobiological Research, Yerseke (Netherlands).
A. B. J. Sepers, G. Cahet, and H. Goossens.
Marine Biology (Berlin), Vol 66, No 3, p 237-242, 1982. 3 Fig, 3 Tab, 14 Ref.

Descriptors: *Mineralization, *Carbon radioisotopes, *Oxygen uptake, *Heterotrophic bacteria, Lakes, Amino acids, Lake Grevelingen, *The Netherlands, Etang Salses Leucate, *France, Bacteria.

The activity of heterotrophic bacteria as measured by carbon mineralization in Lake Grevelingen, the Netherlands (chlorinity 15-17 o/oo) and the Mediterranean Etang Salses Leucate, France (chlorinity 18 o/oo) was more accurately estimated by the oxygen consumption method than the method using C14-labeled substrates. Organic substances added to the lake waters were C14-labeled pyruvate, glycollate, and an amino acid mixture. The maximum uptake rate of the organic compounds was generally < 10% of the carbon mineralization rate calculated from oxygen consumption experiments. During January 1980 glycollate and pyruvate uptakes were 31-38%, with one unusual value for pyruvate, 149%. The higher % were found in winter when heterotrophic activity was low. In Etang Salses Leucate maximum uptake rates were 3.4-4.4% of the mineralization rate calculated from the oxygen consumption rate for the amino acids mixture, 9.7-19.6% for glycollate, and 8.5-34.9% for pyruvate. (Cassar-FRC)
W83-00569

OXYGEN CONSUMPTION AND AMMONIA AND PHOSPHATE EXCRETION IN POND ZOOPLANKTON,
Ceskoslovenska Akademie Ved, Prague. Inst. of Landscape Ecology.
P. Blazka, Z. Brandl, and L. Prochazkova.
Limnology and Oceanography, Vol 27, No 2, p 294-303, 1982. 4 Fig, 4 Tab, 35 Ref.

Descriptors: *Zooplankton, *Oxygen uptake, *Excretion, Ammonia, Phosphates, Cyclops, Daphnia, Invertebrates, Weight, Respiration, Protein, Nitrogen, Carnivores, Herbivores, Temperature effects, Metabolism, Copepods, *Czechoslovakia.

Oxygen consumption and the excretion of ammonia and phosphate were studied in zooplankton in a small eutrophic fish pond at Belice, Czechoslovakia. The principal species was the predatory copepod Cyclops vicinus. Oxygen consumption was linearly related to body size from 11 to 23C and proportional to the 0.86 power of size at 4C. Daphnia and Cyclops containing 1 microgram N took up about 68 microliters 02 per mg N per hour. The curve obtained from plotting oxygen consumption vs. temperature for Cyclops vicinus was similar to that obtained earlier for Daphnia hyalina (Blazka, 1967). Oxygen consumption (in microliters 02 per mg N per hr) was about 20 at 5C, about 50 at 15C, about 75 at 20C, and about 140 at 25C. Oxygen uptake decreased up to 45% in starved C. vicinus. Relationships of excretion rates for N and phosphate and body size were similar to those obtained from oxygen uptake. The oxygen equivalent of ammonia excretion for protein catabolism was never higher than measured oxygen uptake, suggesting that no glucogenesis or lipogenesis occurred in well-fed animals. Relative excretion rates of ammonia in both fasting and well-fed animals increased with concentrations of food present. Phosphate excretion rates also increased with increasing food concentrations, but results of individual experiments were not consistent. The herbivorous plankton had lower N exchange rates than the carnivores, showing that the relative excretion of ammonia increased throughout the food chain. P excretion rates in herbivores and carnivores were not significantly different. (Cassar-FRC)
W83-00571

ELECTRON MICROSCOPIC INVESTIGATION OF MICROORGANISMS IN WATERS OF DIFFERENT COLOR,
I. N. Krylova.
Hydrobiological Journal, Vol 17, No 3, p 22-27, 1981. 4 Fig, 9 Ref.

Descriptors: *Color, *Bacteria, *Morphology, Lakes, Humic acids, Organic matter, Microorganisms, *Electron microscopy, Epilimnion, Metalimnion, Hypolimnion, Oxygen, Dissolved oxygen, Temperature, Estonia, Lake Linayarvi, Lake Mustayarvi, Lake Pikkyarvi, *USSR.

Bacteria in highly-colored, humus-rich waters and in the stratified eutrophic Lake Linayarvi had similar forms at similar depths. Water bodies studied included 3 Estonian lakes: Linayarvi (10 degrees color), Pikkyarvi (240 degrees), Mustayarvi (300 degrees), and a bog stream (1100 degrees). However, temperature and oxygen content were important factors in defining distribution of bacterial forms. In the warm, oxygenated epilimnia of lakes, rod-like bacteria and cocci were most common. In metalimnia with less oxygen, rods, cocci, filamentous bacteria, spirochaetes, and bacteria with stripes and hyphae predominated. In the cold, anaerobic hypolimnia, rods with inclusions of various electron densities were found. (Cassar-FRC)
W83-00575

ECOLOGICAL AND PHYSIOLOGICAL PROFILE OF FILAMENTOUS GREEN ALGAE AS FACTORS IN THE PRODUCTION OF ORGANIC MATTER AND CONTROL OF WATER QUALITY,
Akademiya Nauk URSR, Kiev. Inst. Hidrobiologii.
I. M. Velichko.
Hydrobiological Journal, Vol 17, No 3, p 102-103, 1981.

Descriptors: *Oxygen balance, *Algae, *Self-purification, Photosynthesis, Nutrients, Filamentous algae, *Cladophora, Rhizoclonium, Chlorophyta, Organic matter, Biomass, Lakes, Productivity, Oxygen, Food chains, USSR.

Filamentous green algae in shallow regions of reservoirs play an important part in primary production, enrichment of water with oxygen, nutrient uptake, and self-purification of water. In a growing season this type of alga produces 2.2 g oxygen per g wet weight. Nitrogen comprises 2.65%, and P, 0.30%, of the algae dry weight. About 54% of the biomass is consumed by grazing animals, forming an important link in the food chain. Optimum conditions for Cladophora fracta Kuetz. and Rhizoclonium hieroglyphicum Kuetz. are 20C water temperature, 20,000-30,000 lux illumination, and 1 m compensation depth. The cells produce more oxygen than they respire at algal biomasses of 1-3 kg per cu m. Oxygen balance becomes zero at 6 kg per cu m. (Cassar-FRC)
W83-00576

DIEL DYNAMICS OF PHYTOPLANKTON IN LAKE KANDRY-KUL,
F. B. Shkundina.
Hydrobiological Journal, Vol 17, No 3, p 7-10, 1981. 2 Fig, 7 Ref.

Descriptors: *Phytoplankton, *Diurnal variation, Zooplankton, Grazing, Algae, Lake Kandry-Kul, Species composition, Species diversity, Oligotrophic lakes, Cyanophyta, Chlorophyta, Biomass, *USSR.

The diel variation in phytoplankton in the Bashkirian Lake Kandry-Kul was monitored in July 1979. This oligotrophic lake, 15.5 m deep, 1560 ha area, with a rich fish and bird population, has been recently exposed to recreational use. A total of 130 algal species were found: 10 blue-green algae, 5 pyrrophytes, 51 bacillariophytes, 6 euglenophytes, 3 xanthophytes, and 55 chlorophytes. Dominant species were Gomphosphaeria lacustris Chod. f. lacustris, Gymnodinium fungiforme Aniss., Crucigenia quadrata Morren, Oocyctis lacustris Chod., and Tetrachlorella alternans Korschik. Greatest species diversity was seen at 8 am at 3 m depth (53 species in 1 sample). Overall abundance and biomass was minimum at 3 pm and maximum at 7 pm. Cyanophytes and bacillophytes were most abundant in evening. Protococcaceae and zygnamatales were most abundant at night and during early morning. Reasons for these variations were grazing by zooplankton and changes in the physical and chemical variables. (Cassar-FRC)
W83-00578

PHYTOPHILOUS ASSEMBLAGES OF ORGANISMS IN SARATOV RESERVOIR,
Akademiya Nauk SSSR, Tolyatti. Inst. Biologii Vnutrennykh Vod.
V. I. Popchenko, L. V. Lomakina, and I. I. Popchenko.
Hydrobiological Journal, Vol 17, No 2, p 10-14, 1981. 1 Tab, 5 Ref.

Descriptors: *Macrophytes, *Reservoirs, Aquatic plants, Saratov Reservoir, *USSR, Volga River, Littoral zone, Invertebrates, Plant growth, Plant populations, Organic matter, Fish food organisms.

Saratov Reservoir on the Volga River was created in 1968. About 5-6% of its surface is covered by macrophytes, located in the middle island region and along inundated flood plains. During 1974-77 the 7 plant biotypes were surveyed: lesser reedmance, flowering reed, shining pondweed, willowgrass, yellow and white water lilies, and hornwort in conjunction with Salvinia and duckweed. The zonal distribution of higher water plants is dependent on depth. Growth begins in early June, and reaches maturity by the end of June. Die-off begins in July and reaches a peak in September-October. Peak development for fauna is July-August; for algae, August. The most productive beds are reedmace, pondweed, and hornwort-Salvinia-duckweed. Other biotypes are 5-15 times less productive. This study shows that the higher water plants are a significant factor in the life of the reservoir and must be considered in planning. (Cassar-FRC)
W83-00579

DISPERSION PATTERNS OF PHYTOPLANKTON IN LAKES,
Loughborough Univ. of Technology (England). Dept. of Human Sciences.
R. I. Jones, and R. C. Francis.
Hydrobiologia, Vol 86, No 1/2, p 21-28, January, 1982. 3 Fig, 3 Tab, 38 Ref.

Descriptors: *Phytoplankton, *Spatial distribution, *Sampling, Algae, Lakes, Statistics, Patchiness, Mathematical studies, *England.

Horizontal spatial variation of phytoplankton in a lake was investigated by collecting samples of

varying size from Charnwood Water, a disused gravel pit in Leicestershire, England. The mean cells per ml counted in 20 samples each of 0.1, 0.5, 1, 5, and 10 ml volume were Chroomonas, 336-440; Euglena, 7.6-17.2; Cryptomonas, 0.9-3.5; and Melosira italica, 1.0-1.9. No consistent pattern in the values was discerned. Chroomonas and Euglena showed considerable variance from Poisson distribution at all sample volumes, indicating a contagious distribution. Cryptomonas and Melosira appeared to be randomly distributed in all samples but the 1 and 5 ml sizes (evaluated by the significance of departure from random expectation method) and 0.1 to 1 ml sizes (evaluated by the Morisita index of dispersion). Since most lake water sampling uses a much larger sample size, the micro-contagion demonstrated here is not expected to be significant. However, subsamples used for cell counts should be truly representative. (Cassar-FRC)
W83-00581

DISTRIBUTION OF LITTORAL CRUSTACEANS IN THE PELAGIC ZONE OF LAKE GLUBOKOYE,
N. M. Korovchinskiy.
Hydrobiological Journal, Vol 17, No 3, p 17-21, 1981. 1 Fig, 1 Tab, 10 Ref.

Descriptors: *Zooplankton, *Substrates, *Pelagic zone, Littoral zone, *Crustaceans, Invertebrates, Lake Glubokoye, Species composition, Lakes, Sida crystallina, Floating, Cladocerans, *USSR.

Representatives of 16 littoral crustacean species (11 Cladocera, 3 Cyclopoida, and 2 Ostracoda) were found in the pelagic zone of Lake Glubokoye near Moscow in summer-autumn of 1977. The lake was 15-20 m deep 150-300 m from shore at the study site. Sida crystallina was hundreds of times more abundant than other crustaceans. The constant communication between littoral and pelagic communities is a result of passive transport. Substrates such as floating leaves, debris, boats, and floats encourage movement of the zooplankton, especially in the autumn, as floating leaves are numerous. S. crystallina apparently adapt well to changes from the littoral to the pelagic environment. In fact, fecundity is higher in the pelagic area than in the littoral area because sexually mature females readily cling to the floating substrate and pressures present in the littoral zone are absent in the pelagic area. (Cassar-FRC)
W83-00595

DESTRUCTION OF ORGANIC MATTER BY HIGHER WATER PLANTS UNDER EXPERIMENTAL CONDITIONS,
Akademiya Nauk SSSR, Borok. Inst. Biologii Vnutrennykh Vod.
V. M. Kudryavtsev.
Hydrobiological Journal, Vol 17, No 2, p 43-46, 1981. 2 Fig, 2 Tab, 8 Ref.

Descriptors: *Organic matter, *Decomposition, *Microorganisms, Lakes, Macrophytes, Aquatic plants, Degradation, *Biodegradation, Water lily, Bulrush, Pondweed, Rybinsk Reservoir, *USSR, Oxygen uptake, Bacteria, Fungi.

Degradation of organic matter from aquatic macrophytes (white water lily, bulrush, and shining pondweed) was studied by adding 1 g of pulverized dying plant matter to laboratory bottles and allowing decomposition for 216 days. Total oxygen consumption over the entire study period was 52.29 mg per liter with water lily, 64.5 mg per liter with bulrush, and 29.42 mg per liter with pondweed, 5 to 11 times that of the control, which contained water but no plants. Intensive uptake of oxygen was observed on the first day. It reached a peak on the third day, after which it declined gradually. Total quantity of bacteria reached a maximum of 8.2 million per ml on the third day and declined to 1-2 million per ml by the end of the experiment. The 3 plants decomposed at different rates. At the end of the sixth day 25% of the organic matter in water lily had been destroyed, but only 10% each of the other 2 plants. By the 24th day the percentage of original plant matter destroyed was 50% for water lily, 32% for bulrush, and 28% for pondweed. Final values (216th day) were 80% for water lily, 94% for bulrush, and 58% for pondweed. In the initial stages of decomposition saprophytic bacteria and fungi capable of mineralizing readily oxidizable substances predominated. Later on, cellulose-decomposers and molds using more unavailable compounds were active. (Cassar-FRC)
W83-00597

BIODEGRADATION OF CELLULOSE IN BOTTOM SEDIMENTS OF LAKE BAIKAL,
Irkutskii Gosudarstvennyi Univ. (USSR). Lake Baikal Biological Station.
For primary bibliographic entry see Field 5B.
W83-00600

THE ROLE OF NITROGEN AS A GROWTH LIMITING FACTOR IN THE EUTROPHIC LAKE VESIJARVI, SOUTHERN FINLAND,
National Board of Water, Helsinki (Finland). Water Research Inst.
J. Kanninen, L. Kauppi, and E. -R. Yrjana.
Hydrobiologia, Vol 86, No 1/2. p 81-85, January, 1982. 4 Fig, 1 Tab, 20 Ref.

Descriptors: *Nitrogen fixation, *Nutrients, *Phytoplankton, *Lakes, Limiting nutrients, Nitrates, Phosphates, Lake Vesijarvi, *Eutrophic lakes, *Finland, Biomass, Cyanophyta, Selenastrum, Algal growth, Growth kinetics.

The role of nitrogen in algal growth was investigated in eutrophic Lake Vesiharvi, Finland, during the summers of 1979 and 1980, using Selenastrum capricornutum and Anabaena cylindrica as test organisms. Total N levels varied from 540 to 1400 micrograms per liter and total P from 34 to 310 micrograms per liter. In both years N limited the growth of Selnastrum from May to mid-August. P was limiting for Anabaena, a nitrogen-fixer. Nitrogen fixation and number of heterocysts (on the order of 500,000 per liter) both reached a peak in early July. As ratios of inorganic N to phosphate P decreased to a minimum in July-August, the blue-green algae became dominant, 23-34% of total biomass. (Cassar-FRC)
W83-00604

STUDIES OF THE LIMNOLOGY, FISH POPULATIONS, AND FISHERY OF TURQUOISE LAKE, COLORADO - 1979-80,
Colorado Div. of Wildlife, Fort Collins.
T. P. Nesler.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-110072, Price codes: A03 in paper copy, A01 in microfiche. Bureau of Reclamation Report REC-ERC-82-5, July 1981. 37 p, 5 Fig, 17 Tab, 21 Ref, 5 Append. 7-07-83-V0701.

Descriptors: *Reservoirs, *Reservoir fisheries, *Storage reservoirs, *Fish populations, Colorado, Twin Lakes, Pumped storage, Trout, Fish stocking, Salmon, Nutrients, Oxygen depletion, Oligotrophic lakes, Water temperature, Daphnia, Diatoms.

Turquoise Lake is one of the primary storage reservoirs in the Fryingpan-Arkansas Water Project and provides supplementary water by conduit to the Mt. Elbert Forebay-Twin Lakes system for pump-back storage power generation. The reservoir may be characterized as a dimictic, cold-water lake that is well oxygenated, relatively unbuffered, and slightly acidic. The lake may be classified as oligotrophic on the basis of total dissolved solids, algal nutrients (N-P), and chlorophyll concentrations. Depletion of dissolved oxygen occurs regularly in the hypolimnion during late summer and late winter. Turquoise Lake is limnologically similar to Twin Lakes (Colo.) in most respects, but Twin Lakes may be affected by the colder temperatures of the water imports from Turquoise Lake and from the introduction of Tabellaria and Daphia. The Turquoise Lake fishery is based on the stocked, creel-sized rainbow trout (Salmo gairdneri Richardson), which made up 95% of the 1980 summer harvest. Catch rates have remained in the 0.59-0.70 fish/hour range between 1972-73 and 1980 despite similar levels of rainbow trout stocking and a 45% increase in fishermen effort to 62 000 man-hours (84 hours/hectare). Marked rainbow trout returned in the harvest at only a 28% return rate during one summer season but continued to contribute to the fishery in the following year. Fall stocking of rainbow trout and a good winter survival of these fish contributed significantly to high catch rates in the following spring and summer. Lake trout (Salvelinus namaycush Walbaum) have been unable to establish a self-sustaining population in the reservoir and recruitment past a 356 mm length or 5 years is negligible. The lake trout population must be maintained by periodic stocking. Turquoise Lake demonstrates potential as a kokanee salmon (Oncorhynchus nerka Suckley) fishery and spawn source. (Author's abstract)
W83-00640

INTERACTION OF BACTERIAL PLANKTON AND ZOOPLANKTON IN OLIGOTROPHIC WATER BODIES,
Akademiya Nauk SSSR, Novosibirsk. Inst. of Limnological.
E. L. Afanas'eva, and M. A. Messineva.
Water Resources, Vol 8, No 4, p 457-461, July/August, 1981. 1 Fig, 2 Tab, 4 Ref. Translated from Vodnye Resursy, No 4, p 180-184, July/August, 1981.

Descriptors: *Zooplankton, *Self-purification, *Bacteria, Baccilli, Cocci, Plankton, *Oligotrophic lakes, Crustaceans, Invertebrates, Food habits, Feeding rates, *Lake Baikal, *USSR, Lakes, *Epischura baicalensis.

The crustacean, Epischura baicalensis Sars, was exposed for 24 hours in situ in oligotrophic Lake Baikal in five experiments in March and six in April, 1977. Cocci were the predominant bacterioplankton consumed by Epischura, one crustacean eating 365,000-2.6 million cells per day in March and 200,000-945,000 cells per day in April. In three of the April experiments the consumption of bacilli was detected, amounting to as much as 57% of bacteria consumed. Utilization of the cocci was independent of their initial concentration. Percent of utilization of cocci varied from 19 to 66.3% in March and 12.6 to 49.5% in April. (Cassar-FRC)
W83-00648

LAKE ERIE CLADOPHORA IN PERSPECTIVE,
Ecology and Environment, Inc., Buffalo, NY.
G. C. Millner, and R. A. Sweeney.
Journal of Great Lakes Research, Vol 8, No 1, p 27-29, 1982. 1 Fig, 11 Ref.

Descriptors: *Lakes, *Algal growth, Algae, *Lake Erie, Great Lakes, Nutrients, Seasonal variations, Eutrophication, *Cladophora.

The growth rate, density and distribution of Cladophora were investigated in Lake Erie to determine possible relationships between environmental conditions and Cladophora growth and to establish a systematic data base formulated from the results of U.S. and Canadian studies. The study was conducted over a 2 year period at locations in all three basins of Lake Erie. Each basin displayed a characteristic set of limnological conditions. In general, nutrient concentrations and mean water temperature decrease from west to east, while light penetration increases. These limnological conditions are largely a function of the physical nature and nutrient loading to these basins and are largely responsible for differences in Cladophora growth across the lake. (Baker-FRC)
W83-00661

ECOLOGICAL STUDIES AND MATHEMATICAL MODELING OF CLADOPHORA IN LAKE HURON: 3. THE DEPENDENCE OF GROWTH RATES ON INTERNAL PHOSPHORUS POOL SIZE,
Michigan Technological Univ., Houghton. Dept. of Civil Engineering.
M. T. Auer, and R. P. Canale.
Journal of Great Lakes Research, Vol 8, No 1, p 93-99, 1982. 9 Fig, 23 Ref.

Descriptors: *Algal growth, *Lakes, *Lake Huron, Great Lakes, *Phosphorus, Mathematical models, Model studies, *Cladophora, Algae, Eutrophication.

The relationship between growth rate and internal phosphorus content for Cladophora glomerata was defined. Algal samples were harvested from Lake Huron to represent a range of internal phosphorus concentrations. Rates of net photosynthesis and respiration were measured under controlled conditions of light and temperature using a dissolved oxygen technique. The net specific growth rate and respiration rate were calculated from photosynthesis and respiration measurements using a fixed stoichiometric relationship and the measured carbon content of the algae. The maximum rates for net specific growth rate, gross specific growth rate, and specific respiration rate were 0.77, 1.08, and 0.44/day, respectively. Management decisions may be importantly influenced by these relationships. A non-linear response by growth to reductions in phosphorus loading is suggested from these findings. The internal nutrient status of algal populations must be considered in predicting the impact of phosphorus management strategies on aquatic systems. (Baker-FRC)
W83-00662

VERTICAL CIRCULATION IN DENSITY-STRATIFIED RESERVOIR,
Technical Univ. of Szczecin (Poland). Inst. of Water Engineering.
Z. Meyer.
Journal of the Hydraulics Division, Proceedings of the American Society of Civil Engineers, Vol 108, No HY7, p 853-873, July 1982. 11 Fig, 21 Ref.

Descriptors: *Mathematical models, *Model studies, *Reservoirs, *Density stratification, *Physical properties, Wind, Currents, Flow, Density, Stratification, Density currents, Boundary conditions, Shear stress, Waves.

A mathematical model of vertical circulation in a density-stratified reservoir is presented. The model assumes a two dimensional flow within a rectangular and a semi-infinite strip shaped reservoir. The solutions allow inclusion of a flow generated by inflow and outflow, and wind generated circulation. Basic parameters of the solution are: 1) Boundary conditions at the inflow and outflow; 2) density stratification; 3) surface shear stress or surface velocity at the inflow; and 4) eddy viscosity coefficients. The vertical circulation flow patterns obtained by this model are in good agreement with previous models, and the model includes more factors which have a significant influence on the flow. In particular, horizontal density changes, different eddy viscosities, and the location and strength of inflow and outflow orifices are included. Further research on vertical circulation given vanishing density gradients or axially symmetric flow is needed to provide more general solutions. (Titus-FRC)
W83-00676

2I. Water In Plants

A COMPARATIVE ANALYSIS OF THE C02 AND WATER VAPOR RESPONSES OF TWO SPARTINA SPECIES FROM GEORGIA COASTAL MARSHES,
Smithsonian Institution, Washington, DC. Office of Biological Conservation.
J. R. Giurgevich, and E. L. Dunn.
Estuarine, Coastal and Shelf Science, Vol 12, No 5, p 561-568, 1981. 3 Fig, 1 Tab, 15 Ref.

Descriptors: *Marsh plants, *Transpiration, *Water use efficiency, Carbon dioxide, Soil-water-plant relationships, *Spartina, *Salt marshes, Coastal marshes, Marshes, Stomatal transpiration, Photosynthesis, Temperature effects, Water vapor, Metabolism, Leaves, Conductance, *Georgia.

The carbon dioxide and water vapor exchange of Spartina cynosuroides and Spartina alterniflora were investigated in mid- April 1978 at a salt marsh on the Altamaha River, Georgia. The shape of the C02 response curves, the lack of change in this response at low oxygen concentrations (1-2%) and the low estimates of C02 compensation concentrations indicate that S. cynosuroides has C4 metabolism, as does S. alterniflora. S. cynosuroides showed a strong response of increasing net photosynthesis with increasing radiation. C02 release occurred at low radiation, but C02 exchange was positive at all other levels up to full sunlight at 25C. S. alterniflora showed a strong light response, but rates of photosynthesis were generally less. Both species showed a unimodal response to temperature, the net photosynthesis of S. cynosuroides being markedly higher than that of S. alterniflora. Transpiration of S. cynosuroides increased with increasing temperature and was always higher than the more flattened response curve of S. alterniflora. Water use efficiency of S. cynosuroides was less than that of S. alterniflora at temperatures above 20C. Leaf conductance of S. cynosuroides increased from 15 to 20C but declined progressively thereafter. Leaf conductance of S. alterniflora was also greatest at low temperature and declined more sharply with increasing temperature. Leaf conductance of both species increased with increasing radiation; values for S. cynosuroides were higher than those of S. alterniflora. Evidence suggests that photosynthesis in S. cynosuroides is controlled more by stomatal activity than by internal components; the reverse is true of S. alterniflora. (Cassar-FRC)
W83-00421

GROWTH AND RECESSION OF AQUATIC MACROPHYTES ON A SHADED SECTION OF THE RIVER LAMBOURN, ENGLAND, FROM 1971 TO 1980,
Reading Univ. (England). Dept. of Zoology.
S. F. Ham, D. A. Cooling, P. D. Hiley, P. R. McLeish, and H. R. A. Scorgie.
Freshwater Biology, Vol 12, No 1, p 1-15, February, 1982. 9 Fig, 2 Tab, 14 Ref.

Descriptors: *Macrophytes, *Population dynamics, Populations, Plant populations, Rivers, Ranunculus, Callitriche, Berula, Seasonal variation, *England, River Lambourn.

Macrophytes growing in a shaded section of a chalk stream were studied. A comparison was made with a similar study conducted on a nearby unshaded section of the River Lambourn. With the exception of Ranunculus spp, the changes in total cover did not indicate directly the pattern of growth and recession of the macrophytes. Analysis of gross changes, expressed as gains and losses in cover, indicated that colonization of gravel and silt by the dominant macrophyte, Berula erecta, did not vary seasonally. Colonization was at a constant rate of about 8% of the site each month throughout t he year and this accounted for 50% of the total number of gains by Berula. Gains of Berula from Ranunculus showed an annual cycle with a maximum during the summer when Ranunculus was in recession. Callitriche and Ranunculus both showed an annual pattern of growth and recession. There was temporal separation of the two macrophytes, with Ranunculus growing mainly in spring and early summer and Callitriche showing maximum growth in late summer and autumn, and some evidence of spatial separation. Discharge was thought to be an important variable controlling the growth of Ranunculus, since i ncrease in Ranunculus in the spring was positively correlated with the mean discharge at that time. In years when discharge was low, the growth of Ranunculus appeared restricted by shading from epiphytic algae which accumulated on the plant surfaces under these conditions. (Baker-FRC)
W83-00520

2J. Erosion and Sedimentation

CONTEMPORARY SEDIMENTARY ENVIRONMENTS ON BAFFIN ISLAND, N.W.T., CANADA: GLACIOMARINE PROCESSES IN FIORDS OF EASTERN CUMBERLAND PENINSULA,
Queen's Univ., Kingston (Ontario), Dept. of Geography.
R. Gilbert.
Arctic and Alpine Research, Vol 14, No 1, p 1-12, February, 1982. 7 Fig, 1 Tab, 37 Ref.

Descriptors: *Fiords, *Sedimentation, Sediments, *Baffin Island, Canada, Tidal effects, Aerolian deposits, Gravity flow, Flow, Sand, Silt, Clay, Turbidity, Coriolis force.

Observations were made in fiords on the east coast of Cumberland Peninsula, Baffin Island, to study to sedimentary processes at work there. Several processes were found, including the deposition of ice rafter sediments; the deposition from suspension in overflowing water; the deposition from mass movement including both subaqueous (turbidity currents, nonturbulent flow, slumping of oversteepened deposits on the side walls and sandur forest slopes) and subaerial (slides and falls on valley sides continuing down talus slopes beneath the water), and aeolian deposition. Patterns of current and suspended sediment deposition on the fiord floors are determined in part by the influence of Coriolis force. Despite a small tidal range the absence of sills within the fiords allows free exchange of sea water and frequent or quasi-continuous circulation at depth. Except near the head of the fiords in high energy environments of rapid sedimentation, bioturbation by molluscs and echinoderms destroys many of the fine sedimentary structures. These preliminary findings indicate the possibility of detailed modeling of sedimentary processes in arctic fiords through long term measurement of inflow and the flow regimes at the river mouths which are controlled by tidal patterns, of aeolian processes, of overflow patterns in distal regions, of subaqueous gravity processes, and of barotrophic circulation and exchange at depth. (Baker-FRC)
W83-00400

SHAPE AND DIMENSIONS OF STATIONARY DUNES IN RIVERS,
Technical Univ. of Denmark., Lyngby. Inst. of Hydrodynamics and Hydraulic Engineering.
J. Fredsoe.
Journal of the Hydraulics Division, Proceedings of the American Society of Civil Engineers, Vol 108, No HY8, p 932-947, August, 1982. 10 Fig, 22 Ref.

Descriptors: *Dunes, *Sediment transport, *River beds, Shear stress, Sand, Suspended load, Bed load, Flow resistance, Bed sediment.

The shape and dimensions of sand dunes in rivers were calculated by a mathematical model. Calculations were carried out in 2 steps: (1) the shape of the bed form that develops downstream a rearward-facing step, migrating with a velocity equal to that of the bed form and (2) the height of the bed form, obtained by a perturbation method. By distinguishing between bed load and suspended load it was possible to describe the transition from dunes to a plane bed as the dune height and dune steepness decreased at large bed shear stresses. Flow resistance curves in rivers were obtained by calculating the loss of expansion behind the dune crest by Carnot's formula. The results at low values of shear stress agreed well with those obtained in experiments. (Cassar-FRC)
W83-00451

SIMULATION OF NUTRIENT AND HEAVY METAL TRANSPORT CAPACITY OF SUSPENDED SEDIMENT,
Arizona Univ., Tucson. School of Renewable Natural Resources.
For primary bibliographic entry see Field 4D.
W83-00609

FROZEN SOIL EFFECTS ON THE EROSION HAZARD,
Idaho Univ., Moscow. Dept. of Agricultural Engineering.
E. S. Yen, and M. Molnau.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-125187, Price codes: A04 in paper copy, A01 in microfiche. Completion Report, Idaho Water and Energy Resources Research Institute, Idaho University, Moscow, April 1982. 66 p, 4 Fig, 15 Tab, 40 Ref. OWRT A-070-IDA(1).

Descriptors: *Erosion, *Sediment yield, *Frozen ground, *Seasonal variation, *Runoff, *Mathematical studies, Sedimentation, Erosion rates, Erosion control, Soil erosion, Evaluation, Freeze-thaw tests, Freezing, Ice formation, Runoff forecasting, Runoff rates, Snowmelt, Computer models, Model studies.

A study was conducted to ascertain whether erosion and sediment yield affected by frozen soil are usually worse than on unfrozen soil, and if erosion severity in early winter affected erosion severity in late winter or spring. Changes in surface roughness of three soil plots were determined as a function of freeze-thaw cycles. Runoff energy (RE) and sediment yield (SY) were classified relative to their occurrence on frozen, thawing, or unfrozen soil. Significant differences occurred in RE and SY from snowmelt or rainfall on frozen or unfrozen soil; SY from runoff on thawing/frozen soils was the same, and was significantly different from rain on unfrozen soil. Principal component and cluster analysis of RE, SY, and freeze index (FI) showed there is no statistical relation between RE, FI, or SY in the spring and winter, but that SY in winter is affected by RE, and that FI in winter with spring SY is determined by the spring RE. Further, random roughness on south-facing plots decreased to a base level faster than other aspect plots, but all plots approached the same base level roughness regardless of the orientation considered. The south-facing plot probably decreased faster because of increased frequently of freeze-thaw cycles. (Zielinski-MAXIMA)
W83-00615

2K. Chemical Processes

SELF-CONSISTENT LEAST-SQUARES METHOD OF ESTIMATING CHEMICAL COMPOSITION OF THE SOURCES OF CHEMICAL CONSTITUENTS IN NATURAL WATERS,
Tokyo Inst. of Tech. (Japan). Department of Environmental Chemistry.
M. Tsurumi.
Analytica Chimica Acta, Vol 138, p 177-182, 1982. 3 Tab, 7 Ref.

Descriptors: *Chemical composition, *Geochemistry, *Mixing, Saline water, Springs, Natural waters, Water analysis, *Least squares method, Mathematical studies.

The possible ranges of chemical composition of water sources in a mixed solution (for example, hot spring water, river water, and rain water) are estimated without prior assumption that all of a given element comes from one source. A conventional least squares calculation is applied, using a desktop computer, to identify the number and nature of the water sources and to quantitatively estimate the contribution of each source to the mixture. The example uses a mixture of water from 3 sources: saline water in an oil field, water with dissolved volcanic emission, and mineral spring water rich in Ca and bicarbonate. Constituents under consideration are Li, Na, K, Mg, Ca, Sr, Cl, bicarbonate, and sulfate. When it was presumed that 4 sources were present, the method showed that 2 were the same, for a total of 3 sources. Calculated results agreed with observed results within 10% for most of the elements and anions. (Cassar-FRC)
W83-00353

MELTWATER HYDROLOGY AND HYDROCHEMISTRY IN SNOW- AND ICE-COVERED MOUNTAIN CATCHMENTS,
Victoria Univ. of Manchester (England). Dept. of Geography.
For primary bibliographic entry see Field 2C.
W83-00377

THE EFFECT OF SALINE SEEPS AND RESTRICTED LIGHT UPON THE SEASONAL DYNAMICS OF PHYTOPLANKTON COMMUNITIES WITHIN A SOUTHWESTERN (USA) DESERT CANYON STREAM,
Northern Arizona Univ., Flagstaff. Dept. of Biological Sciences.
D. W. Blinn, M. Hurley, and L. Brokaw.
Archiv fur Hydrobiologie, Vol 92, No 3, p 287-305, October, 1981. 9 Fig, 1 Tab, 24 Ref.

Descriptors: *Saline water, *Phytoplankton, *Light penetration, Water pollution effects, Streams, Canyons, Chevelon Creek, *Arizona, Seasonal variation, Primary productivity, Productivity, Algae, Diatoms, Base flow, Arid lands, Water quality, Succession, Species distribution, Specific conductivity.

Phytoplankton communities were studied in Chevelon Creek, Arizona. This desert stream, which passes through long reaches of steepsided canyons, has large variations in ionic strength in space and time and limited light in some reaches. Saline water seeps from the canyon walls, and flows vary from 1 to 25,300 cu ft per sec. High specific conductance, 3600 micromhos per cm, is maintained from May to December, when winter storms increase runoff and dilute the saline water. Phytoplankton densities are very low, less than 200 cells per liter in winter, with a gradual increase to a maximum of 16,000 to 20,000 cells per liter in August and September. Bacillariophyta and Cyanophyta are the predominant algal groups. Diatoms are the most abundant phytoplankton, except in August and September. Seasonal succession of species corresponding with the ionic concentration occurs during base flow. The succession starts with Thalassiosira pseudonana in early May, when the specific conductance is $>$ 1.0 mmhos per cm. It is replaced by Chaetoceros muelleri when the specific conductance reaches $>$ 2.0 mmhos per cm. Rhizosolenia minima is dominant from the beginning of September until the end of October. Net primary production of phytoplankton is 2-3 times lower in the shaded section of the canyon than in the open sites. (Cassar-FRC)
W83-00398

CATION-EXCHANGE BEHAVIOUR OF A RANGE OF ADSORBENTS AND CHROMATOGRAPHIC SUPPORTS WITH REGARD TO THEIR SUITABILITY FOR INVESTIGATING TRACE METAL S PECIATION IN NATURAL WATERS,
Commonwealth Scientific and Industrial Research Organization, Cronulla (Australia). Div. of Fisheries and Oceanography.
For primary bibliographic entry see Field 5A.
W83-00517

LOW FLOW WATER CHEMISTRY IN FORESTED AND PASTURE CATCHMENTS, MAWHERAITI RIVER, WESTLAND,
Forest Research Inst., Christchurch (New Zealand).
For primary bibliographic entry see Field 5B.
W83-00568

THE DENSITY AND COMPOSITION OF HYPERSALINE WATERS OF A MEXICAN LAGOON,
Mexico Univ., Mexico City.
H. Fernendez, F. Vazquez, and F. J. Millero.
Limnology and Oceanography, Vol 27, No 2, p 315-321, 1982. 6 Fig, 2 Tab, 24 Ref.

Descriptors: *Chemical composition, *Saline water, *Density, *Evaporation, Lagoons, Coastal lagoons, Calcium, Sulfates, Chlorides, Sodium, Potassium, Magnesium, Bromides, Bicarbonates, Salinity, Chemical precipitation, Shallow water, Apozahualco, *Mexico.

The density and chemical composition of Apozahualco, a Mexican coastal lagoon, was measured over an 8 month period. After the rainy season, the lagoon receives little fresh water runoff and is isolated from the sea by a sand bar. During this period evaporation increases salinity of the water from 44 to 186 o/oo. Above a salinity of 90 o/oo CaSO4 precipitation causes decreases in the ratios of Ca:Cl and SO4:Cl. The ratios of Cl to other major constituents, Na, K, Mg, and Br, were fairly constant over the entire evaporation period. The initial Ca:Cl and HCO3:Cl ratios were lower than average seawater values, probably a result of CaCO3 precipitation. The densities of lagoon waters were measured at 20, 25, 30, 35, and 45 C and fit an equation which relates the density of the saline water to the density of water and 3 temperature parameters. Relative densities of the lagoon waters calculated from the equation agreed reasonably well with measured values, which at 25 C ranged from 26.301 at 19.37 o/oo Cl (standard seawater) at 144.072 at 104.33 o/oo Cl. (Cassar-FRC)
W83-00572

ORGANIC MATTER AND THE SURFACE CHARGE OF SUSPENDED PARTICLES IN ESTUARINE WATERS,
Otago Univ., Dunedin (New Zealand). Dept. of Chemistry.
K. A. Hunter, and P. S. Liss.
Limnology and Oceanography, Vol 27, No 2, p 322-335, 1982. 8 Fig, 2 Tab, 50 Ref.

Descriptors: *Organic matter, *Suspended solids, *Surfactants, Estuaries, Electrophoresis, Ionic interference, Salinity, Calcium, Metal oxides, Adsorption, Flocculation, *United Kingdom.

The surface electrical charges on suspended matter in four United Kingdom estuaries were measured as a function of salinity, using the particle microelectrophoresis technique. Two types of behavior were observed. In the Conway and Beaulieu rivers, low in dissolved cations and Ca(++), electrophoretic mobility was negative at all salinities. It increased in value (units, sq m per sec per V) from -1.9 times 10 to the minus 8th power at 0 o/oo salinity to -0.75 times 10 to the minus 8th power at 33 o/oo salinity. In the Alde and Orwell, richer in Ca(++), the electrophoretic mobilities were less affected by salinity: -1.0 to -1.2 times 10 to the minus 8th power sq m per sec per V at 0 o/oo to -0.75 to 0.08 times 10 to the minus 8th power sq m per sec per V at 33 o/oo. No positively charged particles were present. In spite of the mixed nature of the organic matter in the water, the charge distribution was very uniform, indicating that adsorbed organic matter, metallic oxides, or both dominated the surface properties. Apparently differential flocculation of the different suspended minerals is suppressed in estuarine waters. Dissolved organic carbon and surfactants were in concentrations high enough to allow adsorption. Poorly diluted raw sewage was observed in some locations with high surfactant levels. There was no evidence that nonconservative removal of dissolved organic carbon or surfactants occurred. Results showed that laboratory studies of solid/solution reactions in estuarine systems are inappropriate unless the natural surface state of the suspended matter is reproduced. (Cassar-FRC)
W83-00573

2L. Estuaries

BENTHIC COMMUNITIES IN AN ESTUARY WITH PERIODIC DEOXYGENATION,
Commonwealth Scientific and Industrial Research Organization, Cronulla (Australia). Div. of Fisheries and Oceanography.
S. F. Rainer, and R. C. Fitzhardinge.
Australian Journal of Marine and Freshwater Research, Vol 32, No 2, p 227-243, 1981. 3 Fig, 7 Tab, 36 Ref.

Descriptors: *Benthic fauna, *Oxygen depletion, *Environmental effects, *Estuaries, *Dissolved oxygen, Mangrove swamps, Intertidal areas, Sand, Sediments, Invertebrates, Temperature, Salinity, Species diversity, Biomass, Cabbage Tree Basin, Port Hacking, *Australia, Sea grasses.

Species diversity and biomass of benthic fauna were measured in Cabbage Tree Basin, Port Hacking, south of Sydney, Australia. Although nutrient enrichment and pollution are minimal, extreme environmental conditions exist. Over the May 1977 to September 1978 sampling period, temperatures varied from 10.7 to 26.6C, salinity from 6.9 to 36.2 o/oo, and dissolved oxygen from 0 to 352 micro

mol per kg. Six sites were sampled: (1) the mangrove intertidal region, (2) sand overgrown with Zostera seagrass (0.2 m deep), (3) clean sand flat (0.3 m deep), (4) silty sloping sand with Posidonia seagrass (2m deep), (5) silty sloping sand with surface detritus (5 m deep), and (6) deep basin (7.5 m deep). A total of 163 species were collected: 49 at Site (1), 87 at Site (2), 54 at Site (3), 94 at Site (4), 49 at Site (5), and 11 at Site (6). Biomass wet weights (g per sq m) were: Site (1), 1300; Site (2), 1800; Site (3), 93; Site (4), 290; Site (5), 35; and Site (6), 1.6. There were 59 species of polychaetes, 47 of mollusks, 27 of crustaceans, and 30 miscellaneous. Species diversity and evenness showed a variety of patterns. Dissolved oxygen levels were a significant factor in limiting distribution of species; sediment differences or short-term fluctuations in water temperature or salinity were not. Site-related differences were more important than time-related differences. The mangrove, Zostera, and sand flat sites had distinct fauna. It was apparent that there was no simple relationship between environmental harshness and diversity and evenness when calculated from frequency or biomass. (Cassar-FRC)
W83-00407

INTERTIDAL COMMUNITY OFFSHORE FROM THE WERRIBEE SEWAGE-TREATMENT FARM: AN OPPORTUNISTIC INFAUNAL ASSEMBLAGE,
Interstate Electronics Corp., Anaheim, CA. Ocean Sciences Dept.
For primary bibliographic entry see Field 5C.
W83-00409

EXCRETION OF DISSOLVED ORGANIC PHOSPHORUS IN TROPICAL BRACKISH WATERS,
Institut National de la Recherche Agronomique, Thonon-les-Bains (France). Station d'Hydrobiologie Lacustre.
L. Lemasson, and J. Pages.
Estuarine, Coastal and Shelf Science, Vol 12, No 5, p 511-523, 1981. 6 Fig, 2 Tab, 41 Ref.

Descriptors: *Phosphorus, *Excretion, *Plankton, Lagoons, Brackish water, Tropical regions, Seston, Particulate matter, Phytoplankton, Ebrie Lagoon, *Ivory Coast, Organic compounds, Accumulation, Nutrient cycling.

The excretion of dissolved organic phosphorus by plankton populations was measured with P32 tracers in samples from Ebrie Lagoon, Ivory Coast, a tropical brackish lagoon, during the 1977 dry season when hydrologic conditions were very stable. The 5 km wide, 150 km long, shallow lagoon was divided into 6 areas for study. Mean dissolved organic phosphorus excretion was at least 8% of net P absorption and represented 1.7% per hour of the biomass. Only 28% of the biomass was involved in rapid cycling of P. The release of P was inversely proportional to the particulate carbon/particulate nitrogen ratio of the seston and the dissolved inorganic phosphorus concentration. (Cassar-FRC)
W83-00419

DYNAMICS OF MIXING IN ESTUARIES,
Darmouth Coll., Hanover, NH. Dept. of Earth Sciences.
C. B. Officer, and D. R. Lynch.
Estuarine, Coastal and Shelf Science, Vol 12, No 5, p 525-533, 1981. 3 Fig, 6 Ref.

Descriptors: *Mixing, *Salinity, *Estuaries, Model studies, Salt, Mathematical equations, Estuarine environment.

The one-dimensional advective-dispersive equation for a non-conservative substance (Loder and Reichard, 1980) was modified so that salinity replaces longitudinal distance as an independent variable. These simplified relationships were explored in several analytic solutions, illustrating the effects of temporal variation and loss terms in distortion of concentrate-salinity mixing curves. It was concluded that real-time data can be used in constructing concentrate-salinity mixing curves. A one-dimensional spatial variability is not applicable to cases in which depth or transverse variation are important. A general equation suitable for complex problems is given. Its use avoids the complications that often occur when the non-linear advection term is included. (Cassar-FRC)
W83-00420

A COMPARATIVE ANALYSIS OF THE C02 AND WATER VAPOR RESPONSES OF TWO SPARTINA SPECIES FROM GEORGIA COASTAL MARSHES,
Smithsonian Institution, Washington, DC. Office of Biological Conservation.
For primary bibliographic entry see Field 2I.
W83-00421

A NOTE ON THE RELOCATION OF MARSH DEBRIS DURING A STORM SURGE,
North Carolina University at Wilmington. Dept. of Biology.
C. T. Hackney, and T. D. Bishop.
Estuarine Coastal and Shelf Science, Vol 12, No 5, p 621-624, 1981. 1 Fig, 13 Ref.

Descriptors: Marshes, *Organic matter, *Storm surges, Hurricanes, *Salt marshes, *Spartina, *Juncus, Tidal effects, Storm tides, Detritus, *Marsh plants, Coastal marshes, St. Louis Bay, *Mississippi, Wrack.

On July 11, 1979, Hurricane Bob, a low level storm, removed 218,000 kg of unattached dead plant material from a 96 ha salt marsh study area, composed of 12% Spartina marsh and 88% Juncus marsh. Aerial photographs and ground truth data from the St. Louis Bay, Mississippi, site showed that 226,000 kg had been removed and 7700 kg redeposited as 1-15.7 m wide strips of wrack along bands of tall vegetation. Little or no attached, standing plant matter was removed. It was estimated that the exported debris represented 3.7 billion kJ of energy lost or 16.7% of the annual net primary productivity. (Cassar-FRC)
W83-00422

COASTAL ZONE DEVELOPMENT: MITIGATION, MARSH CREATION, AND DECISION-MAKING,
Stanford Univ., CA. Program in Human Biology.
For primary bibliographic entry see Field 6G.
W83-00430

DESORPTION OF RU106, CS134, CS137, CE144 AND AM241 FROM INTERTIDAL SEDIMENT CONTAMINATED BY NUCLEAR FUEL REPROCESSING EFFLUENTS,
JRC, Varese (Italy). Radiochemistry Div.
For primary bibliographic entry see Field 5B.
W83-00437

MICROBIAL METABOLISM OF ACETATE, PROPIONATE, AND BUTYRATE IN ANOXIC SEDIMENT FROM THE COLNE POINT SALT-MARSH, ESSEX, U.K.,
Essex Univ., Colchester (England). Dept. of Biology.
M. T. Balba, and D. B. Nedwell.
Journal of General Microbiology, Vol 128, No 7, p 1415-1422, July, 1982. 3 Fig, 2 Tab, 14 Ref.

Descriptors: *Marshes, *Metabolism, *Fatty acids, *Bacteria, Estuaries, Salt marshes, Anaerobic conditions, Sediments, Acetic acid, Propionic acid, Butyric acid, Volatile acids, Organic acids, Organic compounds, Colne Point Saltmarsh, *United Kingdom.

The in situ metabolism of short chain fatty acids (acetate, propionate, and butyrate) was measured in anaerobic salt marsh sediments by a gas chromatograph/gas proportional counting procedure. Rates of fatty acid metabolism (in nmol per ml per hour) incubated at 6.5C were 4.80 for acetate, 0.30 for propionate, and 0.19 for butyrate. Corrected turnover constants were: acetate, 0.91 per hour; propionate, 0.64 per hour; and butyrate, 1.05 per hour. The rate of acetate turnover decreased rapidly with increasing depth of sediment and was negligible at 20 cm. Only 6% of the acetate was derived from propionate and 7.9% from butyrate. The majority was derived from other precursors, as yet unknown. Turnover of propionate and butyrate was totally inhibited by molybdate, suggesting that sulfate-reducing bacteria were the major group responsible for their metabolism. (Cassar-FRC)
W83-00519

OBSERVATIONS FROM MOORED CURRENT METERS IN SAN FRANCISCO BAY, 1978.
Geological Survey, Menlo Park, CA. Water Resources Div.
For primary bibliographic entry see Field 7B.
W83-00551

HIGH FREQUENCY ENDOGENOUS PERIODICITIES OF CHLOROPHYLL SYNTHESIS IN ESTUARINE PHYTOPLANKTON,
Institut National de la Recherche Scientifique, Sainte-Foy (Quebec). Centre de l'Energie.
J. C. Auclair, S. Demers, M. Frechette, L. Legendre, and C. L. Trump.
Limnology and Oceanography, Vol 27, No 2, p 348-352, 1982. 3 Fig, 1 Tab, 15 Ref.

Descriptors: *Chlorophyll, *Phytoplankton, *Tidal effects, Photosynthesis, Light intensity, Mixing, Estuaries, *St. Lawrence Estuary, Algae, Diatoms, *Quebec.

A natural phytoplankton population, collected April 25, 1979, 8 km off Rimouski, Quebec, in the St. Lawrence Estuary, and isolated in a 1200 liter tank, exhibited 6-hour periodicity in chlorophyll synthesis which coincided with the tides. Nutrients were not limiting. The dominant phytoplankter was the diatom Thalassiosira nordenskioldii. The tidal heights were correlated with the detrended chlorophyll time series. Results suggested that chlorophyll concentrations were greatest during periods of maximum current shear and turbulence. At this time, light was unpredictable and large internal chlorophyll pools were present. At slack water, when the light regime was more stable, lower chlorophyll concentrations were found. This evidence agreed with a model of light-shade adaptation (Falkowski, 1980) in which glutamate pools can be directed toward synthesis of a chlorophyll precursor (low light intensities) or toward glutamine synthesis (high light intensities). (Cassar-FRC)
W83-00570

THE DENSITY AND COMPOSITION OF HYPERSALINE WATERS OF A MEXICAN LAGOON,
Mexico Univ., Mexico City.
For primary bibliographic entry see Field 2K.
W83-00572

ORGANIC MATTER AND THE SURFACE CHARGE OF SUSPENDED PARTICLES IN ESTUARINE WATERS,
Otago Univ., Dunedin (New Zealand). Dept. of Chemistry.
For primary bibliographic entry see Field 2K.
W83-00573

PHYTOPLANKTON OF THE YENISEY BAY,
L. V. Il'yash, and T. I. Kol'tsova.
Hydrobiological Journal, Vol 17, No 3, p 1-6, 1981. 1 Fig, 1 Tab, 7 Ref.

Descriptors: *Phytoplankton, *Species diversity, *Biomass, Rivers, Bays, Deltas, Coastal waters, Arctic zone, Diatoms, Yenisey River, Kara Sea, *USSR, Species composition, Siberia, Euphotic zone.

Phytoplankton of the Yenisey River delta and bay in northern Siberia are characterized by large biomass (up to 20.8 g per cu m) and low species diversity (d= 1.2), a predominance of fresh water species (Asterionella and Melosira granulata), and a community with uniform distribution over depth with respect to species composition, biomass, and abundance. These conditions are a result of exten-

sive mixing of the water. In the Kara Sea, into which the Yenisey empties, most of the phytoplankton are found in the euphotic zone. Biomass is no greater than 7-8 g per sq m. Species diversity is greater because fresh water, brachish water, and marine species are present. In the coastal region further from the influence of the river water there is a community with great diversity (d= 2.5) and small biomass (< 2 g per cu m). (Cassar-FRC)
W83-00577

EFFECT OF VARIABILITY OF RIVER RUNOFF ON SEAWATER INTRUSION INTO RIVER MOUTHS,
Gidrometeorologicheskii Inst., Leningrad (USSR).
I. N. Rusin, and A. Z. Svyatskii.
Water Resources, Vol 8, No 4, p 398-401, July/August, 1981. 3 Fig, 6 Ref. Translated from Vodnye Resursy, No 4, p 103-107, July/August, 1981.

Descriptors: *Saline water intrusion, *Runoff, *River flow, Estuaries, River mouth, Seasonal variation, Numerical analysis, Model studies, Discharge hydrographs, *USSR, Ob Bay.

A numerical model, based on the Hansen-Rattray equations, was used to investigate seawater intrusion into river mouths. A major factor influencing the distance of intrusion was volume of river runoff and its annual distribution. Other factors considered were the channel dimensions, coefficients of friction for the bottom and the ice cover, flow velocity components, density of river water, and elevation above the sea surface. The Hansen-Rattray problem was modified to account for the unsteady state caused by variations of river runoff during the year. The calculated free surface slope was characterized by seaward flattening and agreed well with observed results. The vertical density distribution in the halocline zone agreed less satisfactorily with measured data. To determine the position of a salt water boundary at a given instant it was necessary to investigate its movement as affected by the volume of river runoff during a certain preceding time interval, 3-4 years. (Cassar-FRC)
W83-00673

3. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

MAKING SALT WATER DRINKABLE,
M. C. Holliman.
Current Municipal Problems, Vol 7, No 3, p 460-464, 1981.

Descriptors: *Desalination, *Education, *Scientific personnel, Personnel, Training, Water supply, Water demand, Water shortage, Water resources development.

Fairleigh Dickinson University in New Jersey is now offering a Bachelor of Science degree in desalination of salt water. Such an education program should prove most helpful as the supplies of fresh water keep shrinking and the need for effective and efficient desalination methods increases. One semester of the four year degree program is spent at the West Indies Lab on the Island of St. Croix where students usually work in the lab's desalination facility or at other desalination plants owned by the Virgin Islands' Water and Power Authority and by various companies and hotels. Besides the new plants and desalination facilities that will have to be built in the next few years, there is a need for trained engineers and maintenance personnel immediately, especially in the less technologically advanced areas of the world, many of which are the areas most in need of fresh water. Many way are available for desalination of water including evaporation and condensation, multistage flash distillation, vapor compression distillation, vertical tube evaporation, and reverse osmosis. (Baker-FRC)
W83-00438

REVERSE OSMOSIS IN AN UNSTIRRED BATCH SYSTEM. II. ANALYSIS ON TRANSPORT PHENOMENA ACROSS MEMBRANE,
National Taiwan Univ., Taipei. Dept. of Chemical Engineering.
C.-C. Lin, and G.-J. Tsai.
Separation Science and Technology, Vol 17, No 6, p 839-848, 1982. 10 Fig, 6 Ref.

Descriptors: *Desalination, *Salt rejection, *Reverse osmosis, Simulation analysis, Model studies, *Membrane processes.

A mathematical model developed in a previous paper was used to simulate transport behavior across a membrane in a reverse osmosis unstirred batch system. The model was based on a two-parameter membrane transport mechanism and a salt differential equation. Results of the simulation increased the understanding of the effects of the concentration polarization phenomenon on the throughput rate and on percent salt rejection. Concentration polarization is defined as the buildup of excessive salts adjacent to the membrane. This decreases the driving force of solvent permeation with time. The constants characterizing desalination performance of a membrane were easily obtained by using experimental data with the model. (Cassar-FRC)
W83-00583

DESALTING SEAWATER AND BRACKISH WATERS: 1981 COST UPDATE,
Oak Ridge National Lab., TN.
S. A. Reed.
Available from the National Technical Information Service, Springfield, VA 22161 as DE82-020482, Price codes: A04 in paper copy, A01 in microfiche. Report ORNL/TM-8191, August 1982. 59 p, 12 Fig, 15 Tab, 4 Ref, 2 Append. W-7405-Eng-26.

Descriptors: *Desalination, *Brackish water, *Seawater, *Costs, Electrodialysis, Reverse osmosis, Distillation, Energy Costs.

This is the fourth in a series of desalting cost update reports. Product water costs are estimated based upon second quarter 1981 installed equipment costs, a level fixed charge rate, and energy and site development costs which are current. Cost data are reported for desalting seawater by various distillation systems and by reverse osmosis. Costs of desalting four brackish waters, representative of those found in the US by both reverse osmosis and electrodialysis are also given. Cost data are presented parametrically as a function of energy cost and plant size. The cost of desalting seawater by distillation has increased by 40% during the past two years, while desalting by reverse osmosis has increased during the same period by about 36%. Brackish water desalting by reverse osmosis has only increased by about 12%, and brackish water desalting by electrodialysis is up by 40%. The continued increase in energy costs has had a major impact on all desalination systems. (Moore-SRC)
W83-00642

3B. Water Yield Improvement

EFFECTS OF 2,4-D ON NON-TARGET SPECIES IN KERR RESERVOIR,
Oral Roberts Univ., Tulsa, OK. Dept. of Natural Science.
R. W. Couch, and E. N. Nelson.
Journal of Aquatic Plant Management, Vol 20, p 8-13, January, 1982. 6 Fig, 1 Tab, 16 Ref.

Descriptors: *Aquatic weed control, *Pesticide toxicity, *Aquatic plants, Phytoplankton, Zooplankton, *Herbicides, Aquatic weeds, Weed control, Benthic flora, Macroinvertebrates, Macrophytes, Plant populations, Aquatic populations, Reservoirs, Surface water, *Kerr Reservoir, *Oklahoma, *2,4-D.

Although the herbicide 2,4-dichlorophenoxyacetic acid (2,4-D) has been used for the effective control of many aquatic weeds, including Eurasian watermilfoil (Myriophyllum spicatum L.), since the mid 1940s, its effects on non-target organisms in the aquatic environment have not been studied extensively. This investigation studied the effects of 2,4-D treatment upon phytoplankton, zooplankton, benthic macroinvertebrate, and vascular macrophyte populations in Kerr Reservoir. The herbicide was applied to the Eurasian watermilfoil in the Reservoir at the label-recommended rates, not to exceed a concentration of 2 parts per million in the water. Eurasian watermilfoil control was estimated to be 75% each of the 2 years. The only detrimental effect to non-target species that could be attributed to herbicide treatment was a short term depression of phytoplankton populations in those sites sampled in 1977 where large areas of the reservoir were treated or when the treated areas were in places sheltered from the action of currents and waves. The zooplankton and benthic macroinvertebrate populations increased throughout the summer, with observed variations attributable to normal, seasonal environmental influences. The only non-target macrophytedamage observed either year was the er adication of a 1.0 hectare population of American lotus. It is concluded that 2,4-D did not adversely affect the non-target components in the ecosystems of the Kerr Reservoir. (Carroll-FRC)
W83-00378

THE USE OF HERBICIDES FOR AQUATIC WEED CONTROL IN WATER SUPPLY CATCHMENTS,
Severn-Trent Water Authority (England).
J. M. Hellawell, and K. A. Bryan.
Journal of the Institution of Water Engineers and Scientists, Vol 36, No 3, p 221-233, May, 1982. 1 Fig, 5 Tab, 11 Ref.

Descriptors: *Herbicides, *Aquatic weeds, *Weed control, Water pollution prevention, Aquatic weed control, Safety, Water supply.

The use of herbicides for aquatic weed control is reviewed with attention to official safety clearance procedures, formal approval of efficacy, and guidance for selection. The available herbicides cleared for use in or near water by the Pesticides Safety Precautions Scheme are asulam, chlorthiamid, 2,4-D amine, dalapon, dichlobenil, diquat, fosamine ammonium, glyphosate, maleic hydrazide, and terbutryne. Paraquat and chlorpropham are approved but not presently formulated for aquatic use. Herbicides are most likely to enter the water supply through accidental spills or careless disposal of herbicide containers. Whenever possible, the water authority also uses aquatic-approved herbicides for terrestrial uses. Guidelines for use of aquatic herbicides include: consider non-chemical methods; avoid purely cosmetic weed treatments; and consult with abstractors, riparian owners, and wildlife officials before use. The actual choice of an herbicide is aided by a flow chart which concerns location of weeds in the water course, submergence or non-submergence, season of operation, and type of vegetation to control. A table lists the type of herbicide, plants controlled and not controlled, application time, concentration, safety considerations, and restrictions of the 10 herbicides. The most effective herbicide for each of 54 weeds is given. Herbicides should be used according to manufacturer's directions, first on a small practice area. Concentrates must be mixed at a safe distance from the water's edge. Total weed control is rarely desirable; 75-80% removal is a better goal. (Cassar-FRC)
W83-00496

EVAPOTRANSPIRATION FROM RIPARIAN VEGETATION: WATER RELATIONS AND IRRECOVERABLE LOSSES FOR SALTCEDAR,
California Univ., Davis. Dept. of Land, Air and Water Resources.
D. C. Davenport, P. E. Martin, and R. M. Hagan.
Journal of Soil and Water Conservation, Vol 37, No 4, p 233-236, July-August, 1982. 3 Fig, 2 Tab, 11 Ref.

Descriptors: *Evapotranspiration, *Available water, *Antitranspirants, *Transpiration control, *Tamarisk, Soil water, Transpiration, Stomatal transpiration, Water loss, Evapotranspiration control, Soil-water-plant relationships, *Phreatophytes, California, New Mexico.

Data is presented on rates of irrecoverable evapotranspiration (ET) losses from saltcedar (Tamarix chinensis, Lour) and the variability in those rates due to density, soil water availability, and stomatal resistance. Another study reports on field trials to reduce transpiration by spraying saltcedar with a nontoxic antitranspirant. ET rates from saltcedar varied with weather factors, stand density and water availability. In California, ET in July for a unit area of saltcedar in large drums ranged from 2 mm/day in sparse stands to 15 mm/day in dense stands. When the plants were subjected to stress brought on by low soil water availability and/or high evaporative demand, ET declined and diffusive resistance increased. In June, in a natural saltcedar stand in New Mexico, ET varied from 3 mm to 11 mm/day depending on plant density and weather conditions. When assessing irrecoverable ET losses, care must be taken in extrapolating experimental transpiration data. (Geiger-FRC)
W83-00663

EVAPOTRANSPIRATION FROM RIPARIAN VEGETATION: CONSERVING WATER BY REDUCING SALTCEDAR TRANSPIRATION,
California Univ., Davis. Dept. of Land, Air and Water Resources.
D. C. Davenport, P. E. Martin, and R. M. Hagan.
Journal of Soil and Water Conservation, Vol 37, No 4, p 237-239, July-August, 1982. 3 Fig, 2 Tab, 12 Ref.

Descriptors: *Transpiration control, *Evapotranspiration, *Tamarisk, *Antitranspirants, Water loss, Evapotranspiration control, Soil erosion, Transpiration, Trees, Stomatal transpiration, Available water, *Phreatophytes, *Folicote, Water conservation.

Evapotranspiration (ET) from phreatophytic saltcedar (Tamarix chinensis, Lour) may be reduced by spraying the plant with a non-toxic, wax-based antitranspirant such as Folicote. The antitranspirant does not eradicate the vegetation, thus decreasing soil erosion. In field tests, Folicote sprayed with a backpack mistblower reduced saltcedar ET by 20 to 35% initially and by 10% after one month. When Folicote was sprayed by helicopter, no ET reduction occurred because the large droplet size caused poor foliar adherence. An operational program for antitranspirant spraying on phreatophytes cannot be recommended due to the high cost, the need to improve aerial application techniques, and the need for further studies on the effects of antitranspirants on wildlife. As water becomes more scarce and costly in the future, antitranspirant spraying programs may become more economically feasible in preventing irrecoverable water losses. (Geiger-FRC)
W83-00664

3C. Use Of Water Of Impaired Quality

THE ECONOMICS OF MUNICIPAL WASTEWATER REUSE,
Pennsylvania State Univ., University Park.
For primary bibliographic entry see Field 6B.
W83-00465

SPRINKLER IRRIGATION ANSWERS CITY WASTE PROBLEM,
J. Olsonbaker.
Irrigation Journal, Vol 30, No 1, p 40, 48-49, January/February, 1980.

Descriptors: *Sprinkler irrigation, *Wastewater irrigation, *Wastewater lagoons, Irrigation, Cranbrook, *British Columbia, Alfalfa, Lagoons, Wastewater disposal, Water reuse, Land disposal.

Wastewater irrigation of 1100 acres of alfalfa, using center pivot sprinkler irrigation, has been successful in Cranbrook, British Columbia. Effluent from a 3-cell series lagoon system travels 5 miles downhill through a 22 inch pipe to a 2-pond system, which provides aeration and settling for about a year before the water is used. Storage capacity allows for heavy rains and winter shutdown from October 1 to May 30. The 24-hour operation requires only 3 or 4 persons for 1 shift. Runoff is recycled onto the crop. Harvested alfalfa has a 22% protein content compared with 17.1% for most alfalfa. Problems include runoff from the silty, loose soil and difficulty in finding well-qualified help. (Cassar-FRC)
W83-00574

SURVEY OF JOINT US - USSR EXPERIENCE IN EFFECTIVE USE OF SALINE IRRIGATED LANDS.
Report of the Joint Soviet-American Working Group on Water Resources, L.G. Balaev, Ed. All-Union Research Institute of Hydraulic Engineering and Land Reclamation of the USSR Ministry of Land Reclamation and Water Management, Moscow, 1981. 147 p, 17 Fig, 23 Tab.

Descriptors: *International commissions, *Saline water, *Irrigation practices, *Mathematical models, *Impaired water use, Saline soils, Leaching, Salt tolerance, Drainage water, Irrigation water, Wastewater irrigation, Irrigation effects, Irrigable land, Environmental control, Water quality, Algorithms, Mathematical studies.

Works of Soviet and American Scientists are presented concerning the problem of effectively using saline-irrigated lands. Attention is focused on activities in three general areas: leaching; water and salt considerations; and drainage water use and its environmental impact potential. Specifically, these areas address: the basis of generalized material recommendations on leaching technology on irrigated lands; methods of forecasting water and salt regimens in irrigated areas with drainage systems, with the development and description of algorithms for their calculation; and the use of drainage water for irrigation, and programs for forecasting drainage water quality composition with respect to the problem of environmental control. Proper selection and application of drainage and of leaching irrigation regimes taken together with a proper fertilizer system and other agricultural reclamation measures, contribute to highly efficient use of irrigated saline lands. Further, algorithms can be used to select drainage parameters through their analysis of water and salt regimes. Application of a predictive mathematical model to simulate the effect of saline irrigation on water quality in field conditions typifying irrigation development in the western U.S. is described. (Zielinski-MAXIMA)
W83-00606

LEGAL LIABILITY OF RECLAIMED WATER SYSTEM PROPRIETORS,
Brown and Caldwell, Pasadena, CA.
For primary bibliographic entry see Field 6E.
W83-00620

CHARACTERISTICS AND APPLICATION OF BIG SANDY RIVER, GLENWOOD SPRINGS, AND DOTSERO SPRINGS WATERS IN ENERGY DEVELOPMENT,
Bureau of Reclamation, Denver, CO.
R. J. Eisenhauer.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-111310, Price codes: A03 in paper copy, A01 in microfiche.
Bureau of Reclamation Report REC-ERC-82-12, July 1982. 31 p, 2 Fig, 5 Tab, 19 Ref, 4 Append.

Descriptors: *Saline waters, *Coal slurry pipelines, *Energy development, *Water reuse, *Cooling water, Aquifers, Colorado River, Resources development, Injection wells, Salt-gradient ponds, Solar energy.

There are three point sources that contribute a combined salt load of 344,700 metric tons per year to the Colorado River: Big Sandy River contributes 117,900, Glenwood Springs contribute 163,300, and Dotsero Springs contribute 63,500 metric tons per year. To meet the objective of finding methods for disposal of point source water or for reuse of the saline waters in energy development, a literature study was made and laboratory coal and water slurry tests were performed. Samples of water from BS (Big Sandy) River Wells, GS (Glenwood Springs), and DS (Dotsero Springs) were analyzed for major cations and anions, trace metals, calcium sulfate solubility, total organic carbon, pH, and conductivity. BS, and DS waters could be taken from their aquifers, passed through filters, and used without further processing as transport media in coal slurry pipelines. Any of the three waters can be deep well injected after recovery by dewatering of coal slurries. Chemical characteristics of recovered BS water make it a promising candidate for use as a secondary coolant in binary cooling towers. The GS and DS waters are good candidates for use in solar salt-gradient ponds because of high concentrations of sodium chloride. Owing to the high cost of chemical treatment and desalination, present use of BS, GS, and DS waters for irrigation is not an acceptable option. (Moore-SRC)
W83-00639

EFFECT OF LIQUID WASTEWATER SLUDGE APPLICATION ON CROP YIELD AND WATER QUALITY,
Science and Education Administration, St. Paul, MN.
For primary bibliographic entry see Field 5E.
W83-00656

3E. Conservation In Industry

NEW EVAPORATION PROCESS: KEY TO ZERO DISCHARGE FOR ELECTROPLATERS.
For primary bibliographic entry see Field 5D.
W83-00417

3F. Conservation In Agriculture

DEVELOPMENT PROCESS FOR IMPROVING IRRIGATION WATER MANAGEMENT,
Colorado State Univ., Fort Collins. Dept. of Agricultural Engineering.
G. V. Skogerboe, M. K. Lowdermilk, E. W. Sparling, and J. E. Hautaluoma.
Water Supply and Management, Vol 6, No 4, p 329-342, 1982. 3 Fig, 1 Tab, 4 Ref.

Descriptors: *Irrigation programs, *Water management, *Project planning, Planning, Public participation, Decision making, *Developing countries, Interdisciplinary studies, Farm management, Alternative planning, Water resources development.

A development process for improving irrigation water management features an interdisciplinary approach and a farmer-client involvement. The main purposes, designed to ensure the long-term viability of the system, are increasing the production of existing irrigated lands, improving the equity of income distribution, and conserving water resources. The system, especially intended for developing countries, involves 3 phases: (1) problem identification, (2) solution development, and (3) project implementation. The interdisciplinary team includes physical and social scientists. Effective communication among the disciplines and farmers is emphasized. Special focus is given to listening to farmers' needs and perception of the major farm constraints, since they have extensive relevant information and intuitive understanding. Each of the above 3 phases is subdivided and illustrated by flow charts. Problem identification is broken down into reconnaissance and problem diagnosis, each with 5 steps. Development of solutions consists of identifying plausible solutions, testing and adapting solutions, and assessing solution packages. Project implementation involves authorization, organization, and operation, each divided into 5 or more subheadings. (Cassar-FRC)
W83-00458

AGRICULTURE,
California Univ., Davis.
B. D. Gardner, R. H. Coppock, C. D. Lynn, D. W. Rains, and R. S. Loomis.
In: Competition for California Water, Alternative Resolutions, Engelbert, E., ed., University of Cali-

fornia Press, Berkeley, 1982. p 11-36, 5 Tab, 21 Ref.

Descriptors: *Agriculture, *Crop production, *Farming, *Water costs, *Water use, *Irrigation, Consumptive use, Irrigation efficiency, Cropland, Crop yield, Climates, Soil types, Evapotranspiration, Elasticity of demand, Overdraft, Water reuse.

California is approaching the limits of its developed water supply and in some area groundwater overdraft exceeds replenishment. Agriculture consumptively uses about 85% of the developed supply to irrigate 8 million of the 11 million acres now producing crops. The overall efficiency of agricultural water use is closely tied to units of crop produced per unit of water applied. The amounts of water used are affected by differences in growing season and period, evapotranspiration (ET), cost and irrigation method. Sprinkler system efficiencies range from 75-85%, and drip efficiences may be higher. Water prices range from $1 per acre-foot to as much as $150 in drier regions of the state. Many districts use fixed per-acre charges instead of variable per-acre rates so they will be able to meet debt and overhead costs, and to be able to distribute all the surface water to which they have rights. Critics complain that irrigated agriculture wastes water; however, much of the unused water is recovered, returned to the system, and used again. There are nonrecoverable losses (22 million acre-feet/year) mostly through ET, which cannot be reduced without a concomitant reduction in crop biomass. To reduce on-farm water losses, farmers can adopt new irrigating technologies, cut applications below plant need, change cropping patterns, or stop irrigating some cropland. There are three alternative futures for California agriculture: status quo, which would increase costs but not necessarily make more water available for other uses; marketlike systems for water transfer; and development of new supplies, which is strongly favored by agriculture. (Atkins-Omniplan)
W83-00540

DRIP VS. FLOOD--VITICULTURE RESEARCH: A COMPARISON OF TWO IRRIGATION SYSTEMS IN CALIFORNIA VINEYARDS,
California State Univ., Fresno. Dept. of Viticulture.
V. E. Petrucci.
Irrigation Journal, Vol 30, No 3, p 22-25, May/June, 1980. 2 Tab.

Descriptors: *Irrigation effects, *Irrigation efficiency, *Grapes, *Drip irrigation, Raisins, *California, Fruit crops, Vine crops, Crop yield.

A drip irrigated Thompson seedless grape plot produced 38% more pounds of raisins with 40% less water applied over a 5-year study than a similar flat flood irrigated plot. In most of the years the fruit quality (sugar, acid, pH) and cluster counts were similar in both plots, but the drip irrigated plot averaged more clusters per vine. Raisins of Grade B or better averaged 78.1% in the drip plot and 86.1% in the flood plot. The percentages of final raisins, midgets, and trash were similar for both treatments. (Cassar-FRC)
W83-00588

COMPOSITE PERFORMANCE CHARTS FOR DRIP IRRIGATION TUBING,
Hundtoft (Elgin B.), Inc., Honolulu, HI.
E. B. Hundtoft.
Irrigation Journal, Vol 30, No 3, p 30-31, 34, 39, May/June, 1980. 9 Fig.

Descriptors: *Irrigation design, *Design criteria, *Performance evaluation, *Drip irrigation, Uniformity coefficient, Pressure distribution, Graphical analysis, Flow pattern, Irrigation practices.

Composite performance charts are presented to aid in design of drip irrigation systems. The well-defined behavior relationships between select design and performance (all straight lines) are illustrated in a graph that includes operating pressure, end pressure, Christensen's coefficient of uniformity, average orifice flow rate, and field slope. Using these charts makes it possible to quickly find if maximum hydraulic pressures exceed manufacturer's recommendations, locate areas of the design system which are off-limit, select the most suitable tubing, and minimize costs. The charts eliminate subjective visual judgments and misleading information from flow distribution profiles made with inappropriate units or coordinate scales. (Cassar-FRC)
W83-00589

WASTING WATER,
B. Camenga.
Irrigation Journal, Vol 31, No 3, p 22-23,25,26, July/August, 1981.

Descriptors: *Irrigation efficiency, *Landscaping, *Sprinklers, Lawns, Turf, Irrigation design, Irrigation operation, Maintenance, Water conservation, Nozzles.

Irrigation inefficiency originates in design of the system, installation of the system, or use and maintenance of the system. In times of water shortage landscape watering is often targeted for reduction, partly because waste in this application is so obvious. Use and maintenance problems should be corrected. This involves repairing, cleaning, or replacing defective or missing parts (sprinkler heads and risers, nozzles, pipes, valves, controllers, and fittings) with equipment of equal or better efficiency. An efficient watering schedule should be adopted. Proper design of the system reduces the chaces of operation in wind or after soil is sufficiently wet. Equipment modifications are available for watering slopes and locations subject to foot or vehicular traffic. (Cassar-FRC)
W83-00590

DRIP TESTED ON FLORIDA ORNAMENTALS, EVALUATION OF DRIP IRRIGATION FOR CONTAINER PRODUCTION OF WOODY LANDSCAPE PLANTS,
Agricultural Research Center, Monticello, FL.
D. M. Weatherspoon, and C. C. Harrell.
Irrigation Journal, Vol 31, No 3, p 22-23, May/June, 1981. 3 Tab.

Descriptors: *Irrigation efficiency, *Drip irrigation, *Ornamentals, *Florida, Irrigation practices, Water demand, Water use.

Irrigation efficiencies were 44-80% for drip irrigation and 13-26% for sprinklers used on container-grown woody landscape plants grown in Florida. Two experiments were run. The 1976 experiment used Leader tubes, Micro-drippers, Twin-wall hose, Viaflo tubing, and Rain Bird sprinklers. The 1977 experiment used Leader tubes, Micro-drippers, Vortex emitters, Viaflo tubing, and Roberts sprinklers. Plants were ligustrum, holly, azalea, and juniper. Growth indexes were comparable under all irrigation systems. However, a slight growth suppression, as indicated by visual root ratings, was seen in azaleas and hollies. The most practical drip systems for containers were Micro-drippers and Votex emitters. Drip systems are most practical with wide spacing and large containers. (Cassar-FRC)
W83-00591

IRRIGATION IN AMERICA-TODAY AND TOMORROW,
Water Management Irrigation Association, Beltsville, MD.
M. E. Jensen.
Irrigation Journal, Vol 31, No 4, p 28-29, 33,40, July/August, 1981. 1 Fig, 2 Tab.

Descriptors: *Irrigation, *Cropland, *Sprinkler irrigation, Energy, Trickle irrigation, Drip irrigation, Control systems, Automation, Basin irrigation, Surface irrigation.

Recent developments in U.S. irrigation technology are summarized. Total irrigated acreage has increased from 7.3 million ha in 1939 to 24.7 million ha in 1979. From 1974 to 1979 the largest increases in total area of irrigated cropland have been in the semiarid central and southern Great Plains. The subhumid cornbelt had the largest percentage increases (84%) in irrigated cropland. Sprinklers are featured in systems irrigating 30% of U.S. cropland. Center pivot systems have increased in popularity, hand-move systems have decreased, and side roll systems have remained stable, except for decreases in the cornbelt. Trickle or drop systems have increased by 50% from 1976 to 1979 to a 1979 total of 1% of total irrigated land. Sprinklers have increased partly because of improvements in technology. Irrigation in general has expanded as a result of sustained droughts and good water availability in some areas. Escalating energy costs are expected to slow the expansion of irrigation and promote conversion to low pressure sprinkler systems. New technology features level basin irrigation, automation of surface irrigation systems, and reuse systems. New developments in sprinkler irrigation include linear-move laterals and electronic control systems. In trickle or drip irrigation the micro-tubing emitters have been replaced with compact emitters. Plugging is still a major problem. (Cassar-FRC)
W83-00592

OPTIMAL PLANNING OF IRRIGATION DISTRIBUTION AND APPLICATION SYSTEMS FOR A LARGE IRRIGATED AREA,
Idaho Univ., Moscow. Coll. of Engineering.
K. H. Yoo, J. R. Busch, and C. E. Brockway.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-125195, Price codes: A12 in paper copy, A01 in microfiche. Completion Report, Idaho Water and Energy Resources Research Institute, Idaho University, Moscow, May 1982. 235 p, 24 Fig, 34 Tab, 39 Ref, 6 Append. OWRT B-041-IDA(5), 14-34-0001-8079.

Descriptors: *Optimum development plans, *Multiobjective planning, *Mathematical models, *Irrigation efficiency, *Econometrics, Systems analysis, Optimization, Planning, Irrigation practices, Economic aspects, Water costs, Water use efficiency, Irrigation water, Irrigation design, Irrigation districts, *Idaho, Sprinkler irrigation.

Techniques were developed and applied to a large irrigated area near Idaho Falls in an attempt to obtain optimal solutions for multi-objective planning of this area. The techniques were developed to effectively inventory the area, determine the costs and operating characteristics of irrigation system components, and to obtain optimal system plans using mathematical programming. The mathematical model procedures resulted in optimal irrigation system plans which were based on different specified constraints (e.g.: overall system efficiency; water delivery cost to the system at the headgate; water diversion cost from the distribution system to on-farm application systems). The results were used to determine costs and configurations needed to meet specified efficiency levels. When charging for water, water cost variation over a rather narrow range was effective in increasing overall efficiency to a point; additional charges had little effect. Consolidation plans for two irrigation districts in the study area revealed that it would be most economical to use a high pressure supply and sprinkler application system to attain an overall efficiency greater than 70%. The study results offer descriptive scenarios for assisting planners and irrigators in multiple objective planning decisions. (Zielinski-MAXIMA)
W83-00616

EFFECT OF LENGTH OF FALLOW PERIOD ON WATER STORAGE AND DRAINAGE,
Kansas State Univ., Manhattan. Dept. of Civil Engineering.
J. K. Koelliker, and F. R. Lamm.
Available from the National Technical Information Service, Springfield, VA 22161 as Price codes: A04 in paper copy, A01 in microfiche. Completion Report, Kansas Water Resources Research Institute, Kansas State University, Manhattan, August 1982. 50 p, 14 Fig, 6 Tab, 22 Ref, 2 Append. OWRT A-096-KAN(1), 14-34-0001-9018.

Descriptors: *Fallowing, *Water storage, *Controlled drainage, *Groundwater recharge, *Computer programs, Storage, Tillage, Drainage, Chis-

eling, Economic evaluation, Mathematical models, Simulation analysis, Hydrologic aspects, Hydrologic data, Soil water, Long-Term planning, Wheat, *Kansas.

Double fallowing involves the addition of another year to the 14-15 month fallow period between winter wheat crops. A field experiment was carried out to hydrobiologically evaluate the effect of tillage practices and the amount of residue at the beginning of fallow on the amount of water storage and drainage. Tillage practices minimizing the number of tillage operations (by use of chemicals for weed control and residue maintenance) provided the greatest water storage and drainage. Deep chiseling at the start of the fallow period added further to water storage and drainage. The ability of double fallow to cause drainage enhances groundwater recharge. The most efficient practice to promote drainage (chiseling plus chemical and no-till) was estimated to cause over 50 mm/year over the long term. Optimum increase in soil water content in the top 2 m was found to be about 250 mm. A limited economic analysis estimated the cost of water placed in the aquifer to be about $0.07/cu m ($85/acre-foot). Since the strata overlying the unconfined aquifer in the test area was generally dry, drainage would take 10 years or more to reach the saturated zone without a several-year practice of irrigation. Models are described for estimating double fallow capability by continuous computer simulation. (Zielinski-MAXIMA)
W83-00618

IMPROVEMENT OF IRRIGATION SCHEDULING TECHNIQUES FOR CORN WITH VARIABLE CORN MATURITY RANGE, PLANT POPULATION AND WATER SUPPLY AVAILABILITY,
Nebraska Univ.- Lincoln. Dept. of Agricultural Engineering.
D. G. Watts.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-125278, Price codes: A06 in paper copy, A01 in microfiche. Completion Report, Nebraska Water Resources Center, Nebraska University, Lincoln, June 1982. 110 p, 29 Fig, 7 Tab, 69 Ref, 6 Append. OWRT A-057-NEB(1), 14-34-0001-9029.

Descriptors: *Irrigation practices, *Corn, *Available water, *Crop yield, *Evapotranspiration potential, *Regression analysis, Water supply, Water use, Water demand, Irrigation efficiency, Lysimeters, Moisture meters, Alfalfa, Crop production, Evapotranspiration, Consumptive use, Mathematical studies, Field tests, *Irrigation scheduling, *Nebraska.

Research was carried out to develop improved crop coefficient (CC) functions to assist calculation of evapotranspiration (ET) in the scheduling of corn irrigation. Hydraulic lysimeters were installed and were seeded to three maturity ranges of corn, with four populations of each maturity during several growing seasons. The ratio of crop ET to potential ET (ETP) was calculated to estimate points on the CC function at different growth cycle stages. The ETP was computed by a modified Penman equation calibrated in the region. Comparison was made with ET by alfalfa planted in two lysimeters. The CCs were expressed as a function of accumulated growing degree days from planting, representing a significant procedural improvement since it describes the CC function increase equally well in cold, wet springs or during warm, dry ones. Plant population had no significant effect on ET levels. Partitioning of water use between evaporation and transpiration (T) was altered as populations increased, with more water use attributed to T. Maximum CC values appeared to be more closely related to the stage of growth of the crop than to the leaf area index of the crop. (Zielinski-MAXIMA)
W83-00624

4. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control Of Water On The Surface

GENERATION OF FECAL AND TOTAL COLIFORM SURGES BY STREAM FLOW MANIPULATION IN THE ABSENCE OF NORMAL HYDROMETEOROLOGICAL STIMULI,
Leeds Univ. (England). School of Geography.
For primary bibliographic entry see Field 5B.
W83-00385

PROTECTING STREAMFLOWS IN CALIFORNIA,
California Univ., Berkeley. School of Law.
For primary bibliographic entry see Field 6E.
W83-00425

TAMARISK AND RIVER-CHANNEL MANAGEMENT,
Arizona State Univ., Tempe. Dept. of Geography.
W. L. Graf.
Environmental Management, Vol 6, No 4, p 283-296, July, 1982. 14 Fig, 1 Tab, 35 Ref.

Descriptors: *Tamarisk, *Flood channels, *Groundwater levels, *Phreatophytes, Channel flow, Sedimentation, Flood control, Water table, *Salt River, *Gila River, *Arizona, Floods, Irrigation-return flow, Return water, Effluents, Plant growth, Soil-water-plant relationships, Trees, Dam effects, *Channel improvement.

Tamarisk (Tamarix chinensis Lour.), introduced into the southwest U.S. in 1856 and into the Salt and Gila Rivers, Arizona, about 1890, is widely distributed in flood control channels. Serious flooding has been caused by reduction of channel capacity. The distribution and density of tamarisk reached a peak in 1941 and since then have fluctuated in response to natural processes and human management. Groundwater level is the most significant factor controlling tamarisk growth. The plant begins to disappear when depth to water table exceeds 3-10 m. Water management practices (irrigation and sewage effluent seepage and well injections or withdrawals) that affect groundwater level indirectly influence tamarisk growth. Surface flows are not a major factor, except for spreading and germinating seeds. Floods uproot and destroy trees but also raise groundwater levels and provide water for seed germination. Wastewater effluent discharges and irrigation return water influence tamarisk growth only within a short distance from the input. Tamarisk is most successful in fine-grained silts and clays. Therefore, any condition promoting sediment deposition (low gradients, channel migration, dams) also encourages the tamarisk. Irrigation favors spread of tamarisk, whereas channel clearing reduces tamarisk area. (Cassar-FRC)
W83-00428

THE GANGES BASIN AND THE WATER DISPUTE,
Ministry of Power, Water Resources and Flood Control, Dacca (Bangladesh).
M. Zaman.
Water Supply and Management, Vol 6, No 4, p 321-328, 1982. 1 Fig, 2 Tab, 5 Ref.

Descriptors: *Water allocation, *International agreements, *Flow augmentation, Water rights, Water storage, Water shortage, Water resources development, Water conservation, Water control, Water conveyance, Water management, Water policy, Water transport, *Ganges River, *India, *Bangladesh, Nepal, Brahmaputra River, Hooghly River, Rivers, Irrigation, Canals, Dams, Diversion, Salinity, Treaties, Regulated flow, Regional planning, Snowmelt, Environmental effects.

The highly variable flow of the Ganges River and a barrage constructed by India at Farakka are causes of the 30-year water dispute between India and Bangladesh. Despite continuing negotiations, little progress in resolving differences was attained until the 1970's. Without official agreement India continued diversion up to full capacity of the feeder canal after a trial run in the spring of 1975. This created serious ecological problems in Bangladesh, especially in agriculture. Further negotiations under United Nations auspices produced the Ganges Waters Agreement, November 5, 1977. This established a quota schedule for each country and provided a long-term solution to the problem of augmentation of dry season flows in the river. Although both countries have followed the treaty provisions, a long-term solution has not yet been implemented. Augmentation schemes (irrigation storage dams upstream and on other rivers) have been prepared by India and Bangladesh, but neither country agrees with the other's proposals. Nepal, where storage dams may be located, has recognized the benefits of water resources development and management on a regional basis. These benefits include hydropower generation, flood control, irrigation, and river navigation. Until a permanent agreement can be reached, both sides can substantially reduce loss of water in irrigation systems by locating irrigation projects in proper soil types, improving irrigation practices, and optimizing a more efficient cropping program. (Cassar-FRC)
W83-00455

A STORMWATER MANAGEMENT MODEL FOR THE WEST BRANCH BRANDYWINE CREEK, CHESTER COUNTY, PENNSYLVANIA,
Geological Survey, Harrisburg, PA. Water Resources Div.
R. A. Sloto.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-204892, Price codes: A03 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 81-73, February 1982. 34 p, 8 Fig, 13 Tab, 16 Ref.

Descriptors: *Computer models, *Storm runoff, *Rainfall-runoff relationships, *Flood routing, Urbanization, Flood control, Forecasting, Flood peak, Flood-control storage, Water management, Model studies, Calibrations, Simulation analysis, Optimization, Soil water, Hydrographs, *Pennsylvania, Chester County, West Branch Brandywine Creek basin.

Three subbasins in the West Branch Brandywine Creek watershed were modeled by the Dawdy, Shaake, and Alley distributed-routing rainfall-runoff model. The model for the Honeybrook subbasin could not be calibrated because of nonrepresentative rainfall data. The Coatesville subbasin was calibrated, but not verified. The Modena subbasin was calibrated and verified. Predictive simulations were made using selected storms to examine the effects of projected population and four proposed flood-control structures in the Coatesville and Modena subbasins. Simulations of projected population growth in both subbasins showed that runoff volumes and peak discharges would have a greater percentage increase for low-magnitude floods than for high-magnitude floods. The effectiveness of any flood-control structure in the Coatesville subbasin depends upon the rainfall pattern in the West Branch Brandywine Creek basin and on whether or not it will be located upstream from a flood-control structure. In the Modena subbasin, the simulated effect of proposed flood-control structure PA-428 showed that it would lower the peak discharge of Sucker Run at State Route 82 and either raise or have no effect on peak discharge at West Branch Brandywine Creek at Modena. (USGS)
W83-00562

4B. Groundwater Management

BEYOND SECTION 858: A PROPOSED GROUND-WATER LIABILITY AND MANAGEMENT SYSTEM FOR THE EASTERN UNITED STATES,
National Energy Law and Policy Inst., OK.

For primary bibliographic entry see Field 6E.
W83-00439

EFFECT OF LENGTH OF FALLOW PERIOD ON WATER STORAGE AND DRAINAGE,
Kansas State Univ., Manhattan. Dept. of Civil Engineering.
For primary bibliographic entry see Field 3F.
W83-00618

ECONOMIC EVALUATION OF GROUNDWATER POLICY ALTERNATIVES IN THE NORTHERN GREAT PLAINS,
Nebraska Univ.-Lincoln. Dept. of Agricultural Economics.
R. J. Supalla.
Available from the National Technical Information Service, Springfield, VA 22161 as Price codes: A05 in paper copy, A01 in microfiche. Completion Report, Nebraska Water Resources Center, University of Nebraska, Lincoln, July 1982. 78 p, 25 Fig, 6 Tab, 20 Ref. OWRT B-045-NEB(2), 14-34-0001-8098.

Descriptors: *Groundwater management, *Economic evaluation, *Water use, *Water allocation, *Mathematical models, Economic prediction, Economic aspects, Economic impact, Aquifer systems, Aquifer management, Groundwater storage, Forecasting, Projections, Prediction, Consumptive use, Water demand, Farm management, Income, *Northern Great Plains, Nebraska.

Three groundwater management alternatives (unrestricted water use; a 10-inch allocation; and a 6-inch allocation) were evaluated for an area in south-central Nebraska typifying much of the Northern U.S. Plains. Assessment was made of the impact of each alternative on aquifer conditions, farm income, regional economic outputs, and employment, using analytic mathematical models. A 3-dimensional finite-element groundwater model determined aquifer impacts; a recursive, polyperiod linear program determined farm income effects; and an input-output model measured regional economic impacts. Restrictive groundwater pumpage regulations could significantly extend aquifer life with only minimal reductions in total net farm income. Such restrictions, however, would have very damaging impacts on the regional economy, including employment and population, for at least the next 40 years. The 6-inch allocation option was the most effective in terms of slowing aquifer depletion rates; as of the year 2020, it would reduce the level of aquifer exhaustion by 142,000 acres relative to the unrestricted case, and by 62,000 acres relative to the 10-inch allocation. However, by the same time, it would reduce full-time jobs by 1474 and total population by 3035 people. The unrestricted option offered the least economic impact. (Zielinski-MAXIMA)
W83-00623

4D. Watershed Protection

SIMULATION OF NUTRIENT AND HEAVY METAL TRANSPORT CAPACITY OF SUSPENDED SEDIMENT,
Arizona Univ., Tucson. School of Renewable Natural Resources.
W. A. Gabbert.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-125146, Price codes: A04 in paper copy, A01 in microfiche. M.S. Thesis, 1982. 49 p, 3 Fig, 9 Tab, 23 Ref, 2 Append. OWRT A-105-ARIZ.(1).

Descriptors: *Heavy metals, *Erosion, Sediments, *Sediment Transport, *Sediment yield, *Nutrients, Chemical elements (metal), Stream erosion, Sediment production, Sedimentation, Sediment concentration, Watershed Management, Water Quality, Arizona, New Mexico, *Computer models, *Simulation analysis, *Forested watersheds.

Transport of nutrients and heavy metals by suspended sediments has commonly been ignored in studies of stream export from small watersheds. A prototypical computer simulation model was developed to aid watershed managers and land use planners in estimating the impact of alternative land management practices on nutrient and heavy metal losses due to transported sediments on forested watersheds. Geology and vegetation of a watershed were used as predictors of chemical constituent concentrations in transported sediments. Predictive equations were developed using data collected in an earlier study, which found that differences exist in nutrient and heavy metal concentrations of sediments derived from various geologies and vegetation types. Combinations of vegetation types and geologies considered in this study include: ponderosa pine forests on soil parent material of basalt, sandstone, granite or limestone, and mixed conifer forests on basalt.
W83-00609

NONPOINT-SOURCE POLLUTION CONTROL: A RESOURCE CONSERVATION PERSPECTIVE,
Science and Education Administration, Tifton, GA. Southeast Watershed Research Center.
For primary bibliographic entry see Field 5G.
W83-00665

5. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification Of Pollutants

EXTRACTION-SPECTROPHOTOMETRIC DETERMINATION OF COPPER (II) WITH 4-(2-PYRIDYLAZO) RESORCINOL AND A LONG-CHAIN QUATERNARY AMMONIUM SALT,
Sofia Univ., Sofia (Bulgaria). Dept. of Analytical Chemistry.
D. Nonova, and K. Stoyanov.
Analytica Chimica Acta, Vol 138, p 321-328, 1982. 2 Fig, 6 Tab, 17 Ref.

Descriptors: *Copper, *Metals, *Wastewater analysis, *Pollutant identification, Heavy metals, *Spectrophotometry, Water analysis, Trace levels.

Trace levels of Cu(++) were determined in wastewater by extraction of its 4-(2-pyridylazo)-resorcinol complex in the presence of tetradecyldimethyl-benzylammonium chloride using chloroform and a borate buffer at pH 9.7. The absorbance of the Cu complex was determined at 510 nm by spectrophotometry. Beer's law was applicable over the range 0.1-0.5 micrograms Cu per ml. Sn(++), thiocyanate, iodide, and bromide interfered with the analysis. Other cations and anions either did not interfere or were easily masked. Applying the method to wastewater samples gave results comparable to those obtained with other methods. (Cassar-FRC)
W83-00354

SOLVENT EXTRACTION OF MOLYBDOPHOSPHATE WITH CATIONIC DYES AND SPECTROPHOTOMETRIC DETERMINATION OF MICRO AMOUNTS OF PHOSPHATE IN WATERS,
Okayama Univ. (Japan). Dept. of Chemistry.
S. Motomizu, T. Wakimoto, and K. Toei.
Analytica Chimica Acta, Vol 138, p 329-338, 1982. 6 Fig, 5 Tab, 19 Ref.

Descriptors: *Phosphates, *Pollutant identification, *Water analysis, Phosphorus, *Spectrophotometry, Trace levels, Ethyl violet, Dyes, Ammonium molybdate.

Phosphate in tap water was determined at the level of several ppb using a cationic dye (ethyl violet) and ammonium molybdate to form a colored complex, which was detected at 602 nm in a spectrophotometer. The extraction solvent was cyclohexane:4-methyl-pentan-2-one (1:3 v/v). Ethylenediaminetetraacetic acid was added to increase the stability of the ion-pair during shaking. Other dyes tested and found less satisfactory were crystal violet, p-rosaniline, brilliant green, iodine green, nile blue, Janus green B., rhodamines B and 6G, and methylene blue. In spiked river water and seawater samples, recoveries of P were 97-103% at levels of 9 to 54 micrograms per liter. Ten determinations on a tap water sample produced a mean value of 8.16 micrograms P per liter with standard deviation of 0.11% and relative standard deviation of 1.3%. The method detects orthophosphate and, after a hydrolysis procedure, condensed phosphate (pyro-, meta-, and poly-phosphate). For seawater samples a blank containing NaCl is necessary. As(5+), Sn(++), and Sn(4+) cause interference; silicates, vanadates, tungstates, and other common ions do not interfere. (Cassar-FRC)
W83-00355

INDIRECT DETERMINATION OF SUB-NG PER ML-1 LEVELS OF PHOSPHORUS IN WATERS BY DI-ISOBUTYL KETONE EXTRACTION OF REDUCED MOLYBDOANTIMONYLPHOSPHORIC ACID AND INDUCTIVELY-COUPLED PLASMA EMISSION SPECTROMETRY,
National Research Inst. for Pollution and Resources, Ibaraki (Japan).
A. Miyazaki, A. Kimura, and Y. Umezaki.
Analytica Chimica Acta, Vol 138, p 121-127, 1982. 3 Fig, 4 Tab, 9 Ref.

Descriptors: *Phosphorus, *Spectrometry, *Pollutant identification, Trace levels, *Water analysis, Emission spectroscopy, *Spectroscopy.

Phosphorus was indirectly determined at levels of 5.2 to 45 pg P per ml by extraction of the molybdoantimonylphosphoric acid derivative into diisobutyl ketone (DIBK) and measurement by inductively coupled plasma emission spectrophotometry at the Mo(++) 202.03 nm or Sb(+) 206.83 nm line. Relative standard deviations for 1 microgram P were 2.0% for the Mo measurement and 2.5% for the Sb measurement. The low solubility of DIBK in water made acid washing of the extract unnecessary. As(5+) interfered, but As(3+), Si, Ge, Fe(3+), and most anions did not. Recoveries of P added to artificial seawater in the P range of 0.05 to 5 micrograms were 96-102%. A series of 5 river water samples and 2 seawater samples analyzed by the method described in this paper agreed well with direct measurement of P. (Cassar-FRC)
W83-00380

RAPID SCREENING TECHNIQUE UTILISING HIGH-PERFORMANCE LIQUID CHROMATOGRAPHY FOR ASSESSING ACRYLAMIDE CONTAMINATION IN EFFLUENTS,
Plymouth Polytechnic (England). John Graymore Chemical Lab.
L. Brown, M. M. Rhead, and K. C. C. Bancroft.
Analyst, Vol 107, No 1276, p 749-754, July, 1982. 2 Fig, 22 Ref.

Descriptors: *Acrylamide, *Organic compounds, *Wastewater analysis, *Pollutant identification, Industrial wastewater, Water analysis, *Chromatography.

A rapid screening method for the determination of acrylamide in sewage and industrial effluents is described. Sample cleanup consists of passing the sample through a mixed-resin bed containing anionic, cationic, and hydrophobic resins. Reversed phase high-performance liquid chromatography with ultraviolet detection at 202 nm is used for quantitative determination. Analysis of spiked samples of river water, sewage effluent, and china clay works effluent demonstrated precisions of 10% at 5 and 10 micrograms per liter and 4% at 100 micrograms per liter acrylamide. (Cassar-FRC)
W83-00381

EXTRACTION AND ANALYSIS OF INTERSTITIAL WATER FROM SANDSTONE,
Severn-Trent Water Authority, Birmingham (England). Directorate of Scientific Services.
K. C. Wheatstone, and D. Gelsthorpe.
Analyst, Vol 107, No 1276, p 731-736, July, 1982. 3 Fig, 5 Tab, 3 Ref.

Descriptors: *Interstitial water, *Centrifugation, *Sandstone, Pollutant identification, Cores, Water analysis.

A routine laboratory technique for extracting interstitial water from borehole core samples of sandstone used a high speed centrifuge fitted with 6 titanium sample cups. Operating conditions were 12,000 revolutions per min, the maximum speed of the machine, for a half hour. Water volumes extracted were within + or - 10% of the average. No fractionation effects (changes in chemical composition depending on the amount removed) were observed. Samples were frozen for transfer to the laboratory to prevent water drainage and to preserve determinands such as nitrate and phosphate. (Cassar-FRC)
W83-00382

DETERMINATION OF SELECTED ORGANICS IN TREATED SLUDGES AND ASSOCIATED LEACHATES FROM COAL CONVERSION FACILITIES,
Oak Ridge National Lab., TN.
M. P. Maskarinec, R. S. Brazell, R. W. Harvey, and D. K. Brown.
Analytica Chimica Acta, Vol 139, p 257-266, 1982. 5 Fig, 3 Tab, 9 Ref.

Descriptors: *Organic compounds, *Coal gasification, *Solid wastes, Leachates, Pollutant identification, Extraction, Sludge, Fate of pollutants, Water pollution sources.

Analytical methods were developed for identifying and assessing mobility of organic compounds in coal conversion solid wastes. The 3 wastes were a final wastewater treatment plant sludge, a filtered biological treatment plant sludge, and centrifuged heavy oil residuals. A sequential extraction procedure used acid, base, and organic solvent (methylene chloride) as well as collection of volatile components. Three fractions were obtained: base, acid, and neutral. Each fraction was then chromatographed separately to identify a variety of compounds: polynuclear aromatics, phenols, aliphatic hydrocarbons, and many others. The volatile fraction contained alkylbenzenes and phenolic compounds. Sample extraction efficiency of this method was much greater than that of Soxhlet extraction. Mobility of water-soluble compounds in solid waste was compared using 5 extraction methods. The upward flow column method using distilled deionized water was more effective in extracting organic compounds than the other four procedures, all batch extractions. Of all the compounds leached from the solid wastes, phenolics emerged as the major concern. Others detected were 3-carbon substituted (trimethyl, methylethyl, and propyl) pyridines and phenols, naphthalene, quinoline, substituted naphthalenes, cresol, xylenol, naphthol, and biphenyl. (Cassar-FRC)
W83-00383

DILUENT COMPOSITION FOR USE OF API 20E IN CHARACTERIZING MARINE AND ESTUARINE BACTERIA,
University of West Florida, Pensacola. Dept. of Biology.
M. T. MacDonell, F. L. Singleton, and M. A. Hood.
Applied and Environmental Microbiology, Vol 44, No 2, p 423-427, August, 1982. 3 Tab, 22 Ref.

Descriptors: *Bacteria, *Saline water, *Pollutant identification, *Marine bacteria, API 20E, Estuarine bacteria, Salinity, Vibrio, Aeromonas, Allomonas, Photobacterium.

The influence of diluent composition on the biochemical profiles of 30 marine and estuarine bacteria was evaluated. The 9 diluents consisted of 3 groups: (1) NaCl solutions, 0.85, 2.0, and 3.5%; (2) marine salts at salinities of 8.5, 20, and 35 o/oo; and (3) combinations of 2 or 3 major cations (Na, K, and Mg) equivalent in concentrations encountered in 20 o/oo seawater. Organisms included Vibrio, Aeromonas, Allomonas, and Photobacterium. The diluent composed of 20 o/oo marine salts was significantly more effective than any other diluent. The API 20 E system using this diluent and an incubation temperature of 22C was recommended for rapid characterization of estuarine and marine bacteria. The 20 o/oo diluent identified halophilic strains usually unreactive by the APE 20E system, which normally uses the 0.85% NaCl solution as a diluent. In addition isolates identified as Vibrio parahaemolyticus by the clinical inoculation procedure were actually Vibrio vulnificus. (Cassar-FRC)
W83-00388

AMOEBAE FROM ANTARCTIC SOIL AND WATER,
Massey Univ., Palmerston North (New Zealand). Dept. of Microbiology and Genetics.
T. J. Brown, R. T. M. Cursons, and E. A. Keys.
Applied and Environmental Microbiology, Vol 44, No 2, p 491-493, August, 1982. 2 Tab, 13 Ref.

Descriptors: *Amoebae, *Pathogens, Streams, Glacial streams, Lakes, Rivers, *Antarctic, Water analysis, Acanthamoeba, Naegleria, Vahlkampfia, Hartmanella, Platyamoeba, McMurdo Sound, Cold regions.

Water and soil samples were collected at several locations in the region of McMurdo Sound and Dry Valley, Antarctica. Of the 70 samples taken, 22 contained amoebae capable of clonal growth at 30C. None of the amoebae were pathogenic to mice. Commonly found species were Acanthamoeba, Naegleria, Vahlkampfia, Hartmanella, and Platyamoeba. (Cassar-FRC)
W83-00389

MEASUREMENT OF AQUATIC BIODEGRADATION RATES BY DETERMINING HETEROTROPHIC UPTAKE OF RADIOLABELED POLLUTANTS,
North Carolina Univ. at Chapel Hill. Dept. of Environmental Sciences and Engineering.
For primary bibliographic entry see Field 5B.
W83-00392

USE OF A HYDRIDE-GENERATION TECHNIQUE FOR THE ATOMIC ABSORPTION DETERMINATION OF LEAD IN DRINKING WATER,
National Inst. for Water Research, Pretoria (South Africa).
R. Smith.
Atomic Spectroscopy, Vol 2, No 5, p 155-158, 1981. 4 Fig, 2 Tab, 9 Ref.

Descriptors: *Water analysis, *Atomic absorption spectroscopy, *Lead, Metals, Drinking water, Potable water, Measuring instruments, *Pollutant identification, Hydride generation.

A method for the determination of lead in drinking water is presented. The method incorporates the use of potassium cyanide solution for the reduction of copper interference. For optimum results the pH of the sample solution should be controlled between 1.5 and 2.2. With this method analyses can be carried out which are particularly suitable for the determination of lead in drinking water. Lead at concentrations of about 5 micrograms per liter to 100 micrograms/liter is detectable. (Baker-FRC)
W83-00401

DETERMINATION OF ARSENIC IN SYNTHETIC FUEL PROCESS WATERS,
Perkin-Elmer Corp., Norwalk, CT.
D. C. Manning, R. D. Ediger, and D. W. Hoult.
Atomic Spectroscopy, Vol 1, No 3, p 52-54, 1980. 3 Tab, 22 Ref.

Descriptors: *Arsenic, *Water analysis, *Measuring instruments, Furnace atomic absorption, Inductively coupled plasma emission, *Atomic absorption spectroscopy, Oil shale, Shales, Oil industry, Industrial wastes, Wastewater, Coal gasification, *Pollutant identification.

Four different atomic spectroscopy methods were used to analyze three synthetic fuel process waters. The methods included furnace atomic absorption, inductively coupled plasma emission (ICP), arsine-generation atomic absorption and flame atomic absorption. The three samples were distributed to a number of labs as part of a collaborative study. One was a product water from oil-shale retorting by an aboveground process labeled 'A.G. Retort'. A second was a product water fromtrue in situ oil-shale retorting, I.S. Retort. The third was a product water from an in situ coal gasification experiment, Coal Gas. The results were in good-to-excellent agreement, indicating that any of the analytical methods would be satisfactory for this type of sample, at these concentration levels of arsenic (0.94 to 30 mg/liter). For lower concentration levels, the hydride method or the furnace method would be preferable, as they are more sensitive than the other methods. No sample preparation was needed for the flame or ICP work. Only dilution with the Ni(N03)2 stabilizer was needed for the graphite furnace. For hydride generation, a prior acid digestion was necessary. (Baker-FRC)
W83-00402

INFLUENCE OF VALENCE STATE ON THE DETERMINATION OF ANTIMONY, ARSENIC, BISMUTH, SELENIUM AND TELLURIUM IN LAKE WATER USING THE HYDRIDE AA TECHNIQUE,
Utilitarian Union Lake Constance Water Supply Suessenmuehle, Ueberlingen (Germany, F.R.).
H. W. Sinemus, M. Melcher, and B. Welz.
Atomic Spectroscopy, Vol 2, No 3, p 81-86, 1981. 9 Fig, 2 Tab, 10 Ref.

Descriptors: *Water analysis, *Atomic absorption spectroscopy, *Pollutant identification, Arsenic, Tellurium, Selenium, Antimony, Bismuth, Lakes, Natural water.

The hydride atomic absorption technique was used in the determination of Sb, As, Bi, Se, and Te in lake water. With this technique, lower peak-height sensitivities are found for the higher oxidation states of the group V elements. Bi(V) compounds are generally unstable and thus were not to be expected in natural waters. The oxidation state (VI) of the group VI elements Se and Te gives almost no measureable signal with the hydride AA technique. A prereduction was thus needed for the determination of these elements in natural waters. Due to the extreme sensitivity difference for the two oxidation state of Se and Te, a selective determination of the oxidation state (IV) becomes possible in addition to the total content of these two elements. (Baker-FRC)
W83-00403

DETERMINATION OF DISSOLVED SELENIUM IN FRESH AND ESTUARINE WATERS BY FLAMELESS ATOMIC ABSORPTION,
New York State Dept. of Health, Albany. Div. of Labs. and Research.
V. B. Stein, E. Canelli, and A. H. Richards.
Atomic Spectroscopy, Vol 1, No 3, p 61-65, 1980. 4 Fig, 3 Tab, 19 Ref.

Descriptors: *Water analysis, *Selenium, *Atomic absorption spectroscopy, Natural waters, Estuaries, *Pollutant identification, Metals.

A simplified, sensitive and rapid method for determing low concentrations of selenium in fresh and estuarine waters is described. To control acidity and avoid analyte coprecipitation, the pH of samples was adjusted to 3.0 + or - 0.1 with HN03. To enhance the selenium signal, all samples were fortified with 0.2% nickel, and to increase sensitivity while minimizing matrix interferences, freshwater samples were also fortified with 100 mg/l calcium. The sample or standard was injected into a heated graphite atomizer, and the specific atomic absorbance was measured. Analyte concentrations for fresh waters were calculated from the calibration curves for aqueous solutions, while those obtained for estuarine waters were from measurements of an artificial seawater medium. The analytical range was linear from 5.0 to 100 microg/liter, and the detection limit was 2.5 micrograms/liter in 50 microliter fresh or estuarine samples. In 20-microliter samples, the relative standard deviations at the 5- and 25 microgram/liter level were 22.0 and 2.1% for fresh waters and 29.0 and 4.8% for estuarine waters. A comparison of the method with standard additions showed a significant difference for 21 freshwater samples. However, there

was no significant difference for the 24 estuarine water samples tested. (Baker-FRC)
W83-00404

DETERMINATION OF ARSENIC IN POTABLE, FRESH AND ESTUARINE WATER BY FLAMELESS ATOMIC ABSORPTION,
New York State Dept. of Health, Albany. Div. of Labs. and Research.
V. B. Stein, E. Canelli, and A. H. Richards.
Atomic Spectroscopy, Vol 1, No 5, p 133-137, 1980. 4 Fig, 5 Tab, 16 Ref.

Descriptors: *Water analysis, *Arsenic, *Atomic absorption spectroscopy, Measuring instruments, Potable water, Drinking water, Natural waters, Estuaries, *Pollutant identification.

A precise, accurate and rapid method is proposed for the determination of dissolved arsenic in potable, fresh and estuarine waters. The sample is filtered, adjusted to pH 3.0 with nitric acid and fortified with 0.05% nickel. Potable water samples are also fortified with 100 mg/L calcium. The sample or standard is injected into a heated graphite atomizer, and the specific atomic absorbance is measured. Calibration is done with aqueous standards for potable waters and with arsenic-free saline for estuarine water samples. Twenty-six potable, 16 fresh and 28 estuarine water samples were analyzed for arsenic by the technique and by the method of standard additions. For the 10 microgram/liter spike the means and standard deviations were respectively: in potable water, 9.87 + or - 0.73 micrograms/liter and 9.94 + or - 0.65 micrograms/liter; in the estuarine water, 10.16 + or - 0.71 micrograms/liter and 9.90 + or - 0.76 micrograms/liter; in fresh water, 9.58 + or - 0.36 micrograms/liter and 9.71 + or - 0.49 micrograms/liter. The results for two carbonated water samples analyzed for arsenic by the proposed method were compared to those obtained by standard additions and the arsine-generation method. The concentrations determined by the proposed technique were within 10% of those determined by the other two methods. (Baker-FRC)
W83-00405

OBSERVATIONS ON NITRATE, PHOSPHATE AND SILICATE IN CLEVELAND BAY, NORTHERN QUEENSLAND,
James Cook University of North Queensland, Townsville (Australia). School of Biological Sciences.
T. A. Walker, and G. O'Donnell.
Australian Journal of Marine and Freshwater Research, Vol 32, No 6, p 877-887, 1981. 7 Fig, 2 Tab, 34 Ref.

Descriptors: *Nutrients, *Suspended sediments, *Lagoons, Nitrates, Phosphates, Silicates, Phytoplankton, Salinity, Cleveland Bay, *Australia, Wind-driven currents, Water currents, Sediments, Runoff, River flow, Great Barrier Reef.

Nitrate, phosphate, and silicate concentration were determined monthly from December 1976 to October 1977 in 9 rivers and creeks and in Cleveland Bay in the Townsville region, Australia. Rainfall during the study period was 1568 mm, above the average of 1130 mm. Levels of the 3 nutrients (all in microgram-atom per liter) in rivers were: nitrate, 0-30.2; phosphate, 0-3.32; and silicate, 14-310. Nitrate levels were high during flood runoff, nearly zero at low flow. Phosphate was at uniformly low concentration, except in 2 rivers. Silicate levels were high, fairly constant, with decreases occurring during floods. Runoff during the wet season enriched the water at the marine station poorly with phosphate, moderately with nitrate, and greatly with silicate. Nitrate and phosphate levels were weakly correlated with salinity but were strongly correlated with Secchi disc transparency, indicating that release of nitrate occurred via bottom sediment resuspension, generally produced by intermittent wind-driven events. Addition of nitrate stimulated phytoplankton growth; addition of nitrate and phosphate produced maximum growth. Silicate was not limiting. (Cassar-FRC)
W83-00406

METAL LEVELS IN THE MUSSEL MYTILUS EDULIS COLLECTED FROM ESTUARIES IN SOUTH-EASTERN AUSTRALIA,
New South Wales Univ., Kensington (Australia). School of Food Technology.
M. Wootton, and A. K. Lye.
Australian Journal of Marine and Freshwater Research, Vol 33, No 2, p363-367, 1982. 1 Tab, 10 Ref.

Descriptors: *Mussels, *Shellfish farming, *Metals, Mytilus edulis, *Australia, Estuaries, *Pollutant identification, Mollusks, Heavy metals, Lead, Copper, Chromium, Nickel, Cadmium, Zinc.

Metal levels in Mytilus edulis collected from 5 potential mussel culture sites on the southeast Australian coast showed that Batemans Bay, Lakes Entrance, and Merimbula were more suitable for mussel culture with respect to metals concentrations than Eden and Jervis Bay. Mussels from Eden and Jervis Bay contained the following metals concentrations (all in micrograms per g wet weight); 1.65-6.47 Pb, 2.40-4.91 Cu, 1.06-6.13 Cr, 1.64-5.41 Ni, 0.25-1.11 Cd, and 18.20-70.56 Zn. Only Pb levels exceeded national standards for metal in mollusks (2.5 micrograms per g Pb wet weight). In the less contaminated waters metal levels (in micrograms per g wet weight) in mussels were: 0.37-5.05 Pb, 1.03-3.43 Cu, 0.87-5.86 Cr, 0.99-4.91 Ni, 0.23-0.91 Cd, and 12.73-42.11 Zn. (Cassar-FRC)
W83-00411

TRACE METAL SPECIATION IN THREE VICTORIAN LAKES,
Caulfield Inst. of Tech. (Australia). Dept. of Chemistry.
B. T. Hart, and S. H. R. Davies.
Australian Journal of Marine and Freshwater Research, Vol 32, No 2, p 175-189, 1981. 3 Fig, 3 Tab, 41 Ref.

Descriptors: *Metals, *Lakes, *Speciation, Trace metals, Heavy metals, *Pollutant identification, *Australia, Cadmium, Copper, Iron, Lead, Zinc, Particulate matter, Chemical composition.

Trace metal species (Fe, Cd, Cu, Pb, and Zn) were investigated in 3 lakes in Victoria, Australia. Membrane filtration, Chelex resin, and dialysis were used to separate the metals into particulate, filterable, ion-exchangeable, dialyzable, and bound metal fractions. The 3 lakes were: Lake Tarli Karng, a small, closed deep landslide lake in a forested catchment; Targo Reservoir, located in a eucalypt forest, with stratification and high iron levels; and East Basin Lake, small, closed, and of volcanic origin. Total metal levels and distribution between particulate and filterable fractions varied considerably among the 3 lakes because they were quite different in water chemistry and hydrological properties. Most of the Cd, Cu, Pb, and Zn were in filterable forms, the largest amount of this in ion-exchangeable forms. The ion-exchangeable fraction consisted of free metal ions and simple organic and inorganic complexes. The bound fraction consisted of metal species associated with organic or inorganic colloids as stable or inert species. Iron was found mainly in bound form, usually as the iron hydroxyoxides in colloidal or particulate form. A table lists the values for total metal and each fraction for 2 sampling dates for each of the 3 lakes. Total metal levels were (in micrograms per liter): Cd, 0.1-0.78; Cu, 1.1-4.7; Fe, 150-950; Pb, 0.6-9.7; and Zn, 2.8-14.4. (Cassar-FRC)
W83-00412

BACTERIAL WATER QUALITY: SPRINGS AND STREAMS IN THE GREAT SMOKY MOUNTAINS NATIONAL PARK,
Great Smoky Mountains National Park, Gatlinburg, TN. Uplands Field Research Lab.
D. G. Silsbee, and G. L. Larson.
Environmental Management, Vol 6, No 4, p 353-359, July, 1982. 3 Fig, 4 Tab, 19 Ref.

Descriptors: Parks, *Bacteria, Water supply, *Water quality, Pollutant identification, Water pollution sources, Fate of pollutants, Great Smoky Mountains National Park, *Tennessee, *National parks, Recreation, Swimming, Drinking water, Springs, Streams, Wilderness areas, Coliforms.

Fecal coliforms, fecal streptococci, and total coliforms were determined in water samples from streams and springs in the Great Smoky Mountains National Park, Tennessee. Bacterial densities were significantly higher in summer and autumn than in winter and during and after heavy rain. Larger streams had the highest bacterial levels, which decreased in order of primary streams, seepage springs, and upwelling springs. Most samples exceeded the fecal coliform and total coliform levels specified for drinking water without treatment, but none exceeded Tennessee standards for body contact recreation. Only 1.4% of the samples had no detectable organisms; 80% had bacterial densities $>$ 100 per 100 ml total coliforms. Visitors did not appear to be the major direct contributors to bacterial contamination, as determined by samples taken upstream and downstream of camp sites, picnic grounds, and other visitor sites. Rather, it was believed that bacteria in the soil, leaf litter, and stream sediments from natural sources multiplied more rapidly in the warmer water temperatures of summer and autumn. As a result of these findings, water pipes at natural springs were removed by the park service, and communications to visitors now include instructions to purify all drinking water. (Cassar-FRC)
W83-00426

WATER QUALITY MONITORING: WHAT DIRECTIONS SHOULD NEW PROGRAMS TAKE,
Colorado State Univ., Fort Collins. Dept. of Agricultural and Chemical Engineering.
J. C. Loftis, R. C. Ward, and D. J. Schaeffer.
Environmental Management, Vol 6, No 4, p 279-282, July, 1982. 24 Ref.

Descriptors: *Sampling, *Monitoring, *Data collection, *Water quality standards, Pollutant identification, Water analysis, Network design, Regulations, STORET, Standards, Statistical analysis, Computers, Information systems.

Two responses to the U.S. General Accounting Office's report CED-81-30 are presented. This report criticized the current practices of routine, fixed-station monitoring for river and stream water quality and concluded that synoptic surveys or special studies should replace routine monitoring. The first defendants of the present system point out that routine monitoring, although imperfect, will continue to be an integral part of regulatory water quality monitoring. It is the simplest and least expensive means of checking compliance with a standard. Routine monitoring can be made more efficient, reliable, and economic by improving network design, data collection, and data utilization. The statistical approach to water quality monitoring is receiving increasing attention. The second comment emphasizes the effective use of data in regulatory water quality monitoring. In the past 5 years the availability of the EPA's STORET system and similar systems has been a factor in reducing the amount of unusable data collected. Collected data is under-utilized for 4 reasons: (1) the regulatory maze, (2) existing data on BOD and some of the simpler water quality parameters were not incorporated into the more complicated systems set up by the environmentalists of the 1970's, (3) access to data bases has been difficult, and (4) mathematical tools for handling data have been unavailable or very complex. The experience of water quality monitoring in Illinois is described. Although the sampling program has been redesigned, practical considerations, such as obtaining flow data, etc., have interfered with progress. The best strategy is to use fixed station monitoring with statistically designed schemes with supplemental data from intensive sampling where necessary. (Cassar-FRC)
W83-00429

COMPONENTS OF VARIATION IN LEAD, CADMIUM, COPPER, AND ZINC CONCENTRATION IN HOME DRINKING WATER: THE SEATTLE STUDY OF TRACE METAL EXPOSURE,

National Heart, Lung, and Blood Inst., Bethesda, MD. Epidemiology and Biometry Program.
A. R. Sharrett, R. M. Orheim, A. P. Carter, J. E. Hyde, and M. Feinleib.
Environmental Research, Vol 28, No 2, p 476-498, 1982. 5 Tab, 12 Ref.

Descriptors: *Metals, *Drinking water, Quality control, Variation coefficient, Heavy metals, *Trace metals, *Pollutant identification, Lead, Cadmium, Copper, Zinc, Sampling, *Seattle, *Washington, Chemical analysis, Precision, Standard deviation, Sample preparation, Sample preservation.

Substantial variation in trace metals concentrations (Pb, Cd, Cu, and Zn) was observed in water samples collected from a single home over a period of time during a Seattle, Washington, study. The variation was studied using open and blind duplicates, samples split for analysis at 2 laboratories, and samples collected at the same home several months apart. The variation over time was real. A small portion of the variation was the result of factors operating after sample collection and preservation, for example, use of furnace atomizer. Most variation at higher concentrations was related to intralaboratory factors; most at lower concentrations, to extralaboratory factors. Some of the sources of variation were inadequate mixing of samples containing particulate matter, contamination by or adsorption onto container walls, dilution, sequence of analysis, and operator or instrument errors. (Cassar-FRC)
W83-00432

PHTHALATE ESTER CONCENTRATION VARIATIONS IN DATED SEDIMENT CORES FROM THE CHESAPEAKE BAY,
Ecole Polytechnique, Palaiseau (France). Lab. de Chemie Analytique Physique.
For primary bibliographic entry see Field 5B.
W83-00434

HALOCARBONS AS TRACER SUBSTANCES IN STUDIES OF THE DISTRIBUTION PATTERNS OF CHLORINATED WATERS IN COASTAL AREAS,
Goeteborg Univ. (Sweden); and Chalmers Univ. of Tech., Goeteborg (Sweden). Dept. of Analytical and Marine Chemistry.
For primary bibliographic entry see Field 5B.
W83-00435

CHLOROBENZENES IN SEDIMENTS, WATER, AND SELECTED FISH FROM LAKES SUPERIOR, HURON, ERIE, AND ONTARIO,
Canada Center for Inland Waters, Burlington (Ontario).
For primary bibliographic entry see Field 5B.
W83-00444

DETERMINING FREE AVAILABLE CHLORINE BY DPD-COLORIMETRIC, DPD-STEADIFAC (COLORIMETRIC), AND FACTS PROCEDURES,
Florida International Univ., Miami.
W. J. Cooper, N. M. Roscher, and R. A. Slifker.
Journal of the Americal Water Works Association, Vol 74, No 7, p 10, 362-368, July, 1982. 12 Fig, 4 Tab, 16 Ref.

Descriptors: *Residual chlorine, *Water analysis, *Drinking water, Colorimetry, Stability, Nitrogen trichloride, Chlorine, Potable water, Water quality, *Pollutant identification.

Three methods are described for determining free residual chlorine. Interferences from combined chlorine, color formation and stability, reagent stability, theoretical detection limits, and accuracy and precision of data, as well as the feasibility of preparing pure aqueous solutions of nitrogen trichloride are considered. The free available chlorine test with syringaldazine (FACTS) procedure showed no intrusion into the FAC reading from ammonium chloride concentrations up to 24 mg/l 1 min after mixing the reagents. After 5 min, the two high concentrations of ammonium chloride did yield an apparent free chlorine reading of about 0.2 mg/l. The N,N-diethyl-p-phenylenediamine (DPD) colorimetric procedure showed no intrusion into the FAC reading from ammonium chloride concentrations up to 24 mg/liter, 1 min after mixing for the two lower levels of ammonium chloride, 1.2 and 3.5 mg/l. At ammonium chloride concentrations of 6.4, 13.2 and 24.2, apparent free chlorine levels were 0.2, 0.54, and 1.35, respectively, after 1 min. Under stability considerations, the DPD procedures showed greater fading of colored product at lower FAC concentrations than at higher concentrations. In all cases fading was higher than for data previously published for the FACTS procedure. Stability of DPD reagent depends on pH. Thioacetamide solution were tested through 4.5 months with no adverse aging effect noted. All three procedures showed intrusion of NC13 into the free chlorine readings, with the magnitude of intrusion being greater for FACTS at the two higher NC13 concentrations and greater for the DPD procedures at the two lower NC13 concentrations. (Baker-FRC)
W83-00453

BIOLOGICAL SURVEILLANCE OF RIVERS,
Aston Univ., Birmingham (England). Dept. of Biological Sciences.
H. A. Hawkes.
Water Pollution Control, Vol 81, No 3, p 329-342, 1982. 6 Fig, 4 Tab, 39 Ref.

Descriptors: *Monitoring, *Biological samples, *Sampling, *Rivers, Water pollution effects, Classification, Benthic fauna, Water quality, Species diversity, Diversity indices, *Pollutant identification.

Biological surveillance is an essential complement to physicochemical surveillance in monitoring river water quality. Biological surveillance can contribute to knowledge of water quality because benthic communities reflect the continuous, rather than intermittent, water quality; they respond to a wide range of pollutants; and they are good indicators of the effects of pollutants on fish. However, there are some limitations. Biological surveillance cannot identify the chemicals causing an observed change. Sampling and identification involve considerable effort. Data generated from a biological survey are often hard to understand by non-biologists; indexes often obscure information. Although water may be designated of good quality by biological surveillance, it may contain harmful trace organics or pathogens. Sampling methods are described. In the United Kingdom methods rely on benthic samples collected, if possible, from shallow stretches with a strong bottom or eroding substratum. Many indexes for water quality exist: the saprobic system, biotic indexes, diversity indexes, a classification system (characterized by indicative groups of animals), the BMWP score (biological monitoring working party), and ecological validity (based on changes in indicator species). (Cassar-FRC)
W83-00472

CONTINUOUS MONITORING, AUTOMATED ANALYSIS, AND SAMPLING PROCEDURES,
Oak Ridge National Lab., TN.
W. W. Pitt, Jr., and M. S. Denton.
Journal of the Water Pollution Control Federation (Literature Review Issue), Vol 54, No 6, p 576-583, June 1982. 107 Ref.

Descriptors: *Automation, *Water quality control, *Water sampling, *Literature review, Sampling, Monitoring, Effluents, Water analysis, Continuous monitoring, Computers, Wastewater analysis, Process control, *Pollutant identification, Bioindicators, Heavy metals, Water pollution control.

Publications on monitoring strategies and sampling protocols, continuous monitoring applications, automated analyses, biological monitoring systems, and sampling procedures and devices are reviewed. Effluent monitoring was emphasized. Other papers covered sampling networks; wastewater and groundwater monitoring; selection of sampling techniques, frequencies, and equipment; and the importance of equipment cleanliness and filtering apparatus. In the area of pollution control monitors, there were significant developments in the determination of COD, BOD, total organic carbon, and alkalinity; in monitors and alarms for reporting spills; in the chemical processes area of the industrial sector; in the utilities industry; and in a class A monitor for general use with water systems for continuous analysis. On-line process control monitoring experienced growth in electronic devices for sludge/wastewater treatment, biotreatment, energy production facilities, and industrial chemical processing. Process liquid chromatography was studied. Publications on automated analyses covered the use of rapid and automated measurements that were not continuous or on-line. Biological monitoring systems to screen natural waters for heavy metals were cited. An evaluation of macroreticular resins for the sampling of organics in water was cited along with a description of a multichannel positive displacement apparatus for collecting composited samples of waterborne trace organics. (Gish-FRC)
W83-00488

INACCURACY OF THE PREINCUBATION MODIFIED M-FC METHOD FOR ESTIMATING FECAL COLIFORM DENSITIES IN MARINE WATERS,
Rhode Island Univ., Kingston. Dept. of Microbiology.
V. J. Cabelli, F. T. Brezenski, and D. Pedersen.
Journal of the Water Pollution Control Federation, Vol 54, No 8, p 1237-1240, August, 1982. 1 Fig, 7 Tab, 13 Ref.

Descriptors: *Coliforms, *Bacteria, *Incubation, *Pollutant identification, Microbiological studies, Marine environment, Estuarine environment.

Two methods for estimating fecal coliform densities in marine and estuarine water samples were compared. The mM-FC method was the M-FC method modified by preincubation of plates for 2 hours at 35C and incubation at 44.5C for 22 additional hours. The mTEC membrance filter involved counting all the yellow colonies on the filter prior to performance of the in situ urease test to distinguish between E. coli and Klebsiella. In general, the mM-FC procedure gave lower estimates than the mTEC method for E. coli. Mean fecal coliform recoveries (in cells per 100 ml) for mM-FC and mTEC respectively were: New Jersey coast, 8.8 vs. 31.3; Long Island coast, 10.1 vs. 19.3; 6 Staten Island sites, 8.7-55.5 vs. 28.3-207; 6 Coney Island sites, 5.6-48.4 vs. 60.2-269. The confirmation frequency for the mTEC method was 92-100%, depending on the station. (Cassar-FRC)
W83-00491

AN AUTOMATIC VOLTAMMETRIC ANALYZER FOR THE SIMULTANEOUS DETERMINATION OF TOXIC TRACE METALS IN WATER,
Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Angewandte Physikalische Chemie.
For primary bibliographic entry see Field 7B.
W83-00510

CATION-EXCHANGE BEHAVIOUR OF A RANGE OF ADSORBENTS AND CHROMATOGRAPHIC SUPPORTS WITH REGARD TO THEIR SUITABILITY FOR INVESTIGATING TRACE METAL S PECIATION IN NATURAL WATERS,
Commonwealth Scientific and Industrial Research Organization, Cronulla (Australia). Div. of Fisheries and Oceanography.
D. J. Mackey.
Journal of Chromatography, Vol 242, No 2, p 275-287, 1982. 12 Fig, 1 Tab, 30 Ref.

Descriptors: *Adsorbents, *Trace metals, *Ion exchange, *Speciation, Activated carbon, Resins, *Chromatography, *Pollutant identification, Adsorption, Metals, Iron, Copper, Zinc, Magnesium, Cation exchange.

The behaviour of adsorbents and chromatographic supports in adsorbing trace metals from water was

studied using a liquid chromatograph with an atomic fluorescence detector. The stock solution contained 10 mg per liter each of Fe, Mg, Cu, and Zn at pH 2.5. XAD-2, Chromosorb 101 and 102, Porapak P, PS, Q, and QS, Benson BN-X4 and BN-L10 (all cross-linked polyaromatic resins) and Sep-Pak (octadecyl bonded silica) acted as cation exchange resins with capacities of about 0.1-0.5 microequivalents per g. Norit A (activated carbon) and XAD-7 and 8 (polyacrylic ester resins) had much higher cation exchange capacities. Although the cation exchange capacities reported in this study are low, they can significantly affect results in studies of metal speciation in natural waters. The structure of the octadecyl bonded silica offers the possibility of using this in speciation studies because metal-organic complexes may be more easily desorbed. However, elutants are limited to pH 2-8, and the silica surface must be bonded to as many alkyl groups as possible, since free silanol groups bond strongly to trace metals. (Cassar-FRC)
W83-00517

CHEMILUMINESCENCE METHOD FOR THE DETERMINATION OF TRACE AMOUNTS OF PROTEINS IN NATURAL WATERS,
Kiev Polytechnical Inst. (USSR).
L. V. Kalabina, B. I. Nabivanets, and I. S. Matsko.
Hydrobiological Journal, Vol 17, No 3, p 90-96, 1981. 4 Fig, 5 Tab, 9 Ref.

Descriptors: *Water analysis, *Proteins, *Chemiluminescence, *Pollutant identification, Amino acids, Luminescence, Hydrolysis, Trace levels, *USSR, Dniepr River.

The chemiluminescence method detected protein in natural water at levels of 1 microgram per 25 ml water at reproducibilities of 4-10%. It was based on dialysis of the water to remove interfering material, hydrolysis of protein using a base (barium hydroxide), followed by determination of the liberated amino acids by measuring the inhibitory effect on the oxidation of luminol by hydrogen peroxide in the presence of Cu. Sensitivity of different proteins varied from 5 micrograms per 5 ml for human albumin to 1200 micrograms per 5 ml for trypsin. Water samples from the Dniepr River, collected March 1978, contained 1.4-9.6 micrograms protein per 25 ml water. (Cassar-FRC)
W83-00580

RA-228, RA-226, RN-222, IN SOUTH CAROLINA GROUND WATER: MEASUREMENT TECHNIQUES AND ISOTOPE RELATIONSHIPS,
South Carolina Univ., Columbia. Dept. of Geology.
J. Michel, P. T. King, and W. S. Moore.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-125286, Price codes: A04 in paper copy, A01 in microfiche. Water Resources Research Institute Technical Report No 95, Clemson University, Clemson, South Carolina, January 1982. 57 p, 11 Fig, 6 Tab, 27 Ref, 1 Append. OWRT B-127-SC(2), 14-34-0001-9158.

Descriptors: Water pollution, *Radioactive tracers, *Radioactivity techniques, *Radium radioisotopes, *Radioecology, *Spectroscopy, Radioactive wastes, Radioactivity, Radiochemical analysis, Radioisotopes, Radon, Uranium, *South Carolina, Thorium, Groundwater pollution, Water analysis, Well water, Gamma radiation, *Pollutant identification.

A new technique using gamma-ray spectroscopy was developed for the accurate measurement of radium (Ra) isotopes in natural water, and applied to the determination of Ra-228 and Ra-226 activities in over 180 public water supplies from wells in igneous and metasedimentary rocks in the South Carolina Piedmont province and in Coastal Plain sediments. It was found that the migration distances of Radon-222, Ra-226, and Ra-228 by groundwater were similar, and that temporal variations of the isotopes were negligible. Further, the groundwater isotope data for the Coastal Plain province closely paralleled the NURE Augusta 1-degree by 2-degree stream sediment data. Analysis showed the Upper Coastal Plain to have high radio element levels. Correlation of thorium and uranium (U) in stream sediment and Ra-229 with Ra-226 in groundwater showed that the noted elevated U abundances in the Upper Coastal Plain were probably not from secondary concentration by geochemical processes. While the findings may exclude use of Ra isotopes as natural tracers of groundwater age, the groundwater Ra-228/Ra-226 activity ratio appears directly related to the relative abundances of thorium and U in the aquifer solids. Thus, groundwater Ra content could be used as a U exploration tool. (Zielinski-MAXIMA)
W83-00625

EVALUATION OF THE TENTATIVE STANDARD METHOD FOR ENTERIC VIRUS CONCENTRATION AND DETECTION,
North Carolinia Univ. at Chapel Hill. School of Public Health.
M. D. Sobsey.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-108416, Price codes: A05 in paper copy, A01 in microfiche. Environmental Protection Agency Project Summary EPA-600/S1-81-061, February 1982. 4 p.

Descriptors: *Viruses, *Drinking water, *Water analysis, *Virus concentration methods, Coxsackie virus, Enteroviruses, Polioviruses, Water quality, Water pollution.

The tentative Standard Method (TSM) for concentrating enteric viruses from large volumes of drinking water and other finished waters was evaluated for nine enteric viruses using 100-gal tap water volumes experimentally contaminated with about 100 plaque-forming units (PFU) of virus. The mean recoveries of poliovirus-1, coxsackieviruses A9 and B3, echovirus 7, bovine enterovirus 1, Minute Virus of Mice (parvovirus), reovirus 3, adenovirus 5 and simian adenovirus 11 were 22, 25, 2.5, 6.7, 22, 5.0, <1, <1, and <1%, respectively. TSM recoveries for purified, dispersed mixtures of enteroviruses obtained from raw sewage and seeded into 100-gal volumes of tap water averaged only 3.9%. Enterovirus recoveries showed marked seasonal variations that may be related to water quality changes. Reduced virus recovery was partly due to interference with virus adsorption to filters caused by soluble or colloidal tap water constituents that were removed by granular activated carbon. The effects of these interferences could be overcome by adding aluminum or magnesium chloride to enhance virus adsorption. Low virus recoveries by the TSM were also due to virus inactivation by the pH 11.5 glycine - NaOH used for eluting adsorbed viruses from filters. Improved virus recoveries were also obtained with adsorbent filters that are more electropositive than TSM filters. (Moore-SRC)
W83-00629

DEVELOPMENT OF ANALYTICAL TEST PROCEDURES FOR ORGANIC POLLUTANTS IN WASTEWATER - APPLICATION TO PESTICIDES,
Midwest Research Inst., Kansas City, MO.
H. Miller, P. Cramer, A. Drinkwine, A. Shan, and G. Trischan.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-132507, Price codes: A05 in paper copy, A01 in microfiche. Environmental Protection Agency Project Summary EPA-600/S4-81-017, January 1982. 4 p, 2 Tab.

Descriptors: *Wastewater analysis, *Pesticides, *Industrial wastewater, *Chromatography, Effluents, Cost analysis, Monitoring.

Pesticides are an important group of toxic compounds which have come under scrutiny for control by the National Pollutant Discharge Elimination System permits program. Procedures were developed for monitoring concentrations of 58 pesticides in industrial discharge wastewater. Objectives were to minimize the cost of performing the analysis and maximize the probability of obtaining accurate results. The procedures involved: solvent extraction; extract concentration; adsorbent column cleanup; and gas or high pressure liquid chromatographic determination. The procedures were developed and evaluated using relevant industrial wastewater. In order to minimize the cost of performing the analysis, three ideas were incorporated in the philosophical approach to the method development: multiresidue methods, wherein several compounds may be determined by one analysis were favored; standard analytical techniques and instruments, in common use, were incorporated in the methods; and techniques used in approved EPA procedures were favored because of their future side-by-side use with these pesticide methods. (Moore-SRC)
W83-00632

MONITORING TO DETECT GROUNDWATER PROBLEMS RESULTING FROM ENHANCED OIL RECOVERY,
Energy Resources Co., Inc., Cambridge, MA.
For primary bibliographic entry see Field 5B.
W83-00635

THE USE OF URIC ACID AS A METHOD OF TRACING DOMESTIC SEWAGE DISCHARGES IN RIVERINE, ESTUARINE AND COASTAL WATER ENVIRONMENTS,
Plymouth Polytechnic (England).
L. Brown, J. Braven, M. M. Rhead, R. Evens, and E. I. Butler.
Water Research, Vol 16, No 9, p 1409-1411, September, 1982. 1 Fig, 1 Tab, 6 Ref.

Descriptors: *Uric acid, *Tracers, *Effluents, Nitrogen compounds, *Pollutant identification, *Chromatography, Estuarine environment, Coastal waters, Fate of pollutants, Saline water.

A high performance liquid chromatographic method for determining low levels of uric acid in estuarine and coastal waters was developed. This acid, present in untreated sewage but not in unpolluted waters, is useful as a tracer for sewage in water bodies. The procedure can handle samples containing 1-10,000 micrograms per liter of uric acid. Precision is + or - 20% at 2 micrograms per liter, + or - at 40 micrograms per liter, and + or - 2% at 10,000 micrograms per liter. Samples collected from the Tamar Catchment, England, contained 450-2600 micrograms uric acid per liter untreated sewage, 590-2750 micrograms per liter primary effluent, < 1 microgram per liter secondary effluent, and 290-350 micrograms per liter secondary effluent plus storm overflow. No uric acid was detected in waters unaffected by recent domestic sewage discharges. (Cassar-FRC)
W83-00646

MICROBIOLOGY: DETECTION OF BACTERIAL PATHOGENS AND THEIR OCCURRENCE,
Environmental Protection Agency, Cincinnati, OH. Drinking Water Research Div.
D. J. Reasoner.
Journal of the Water Pollution Control Federation (Literature Review Issue), Vol 54, No 6, p 946-980, June, 1982. 7 Tab, 147 Ref.

Descriptors: *Literature reviews, *Bacteria, *Public health, Reviews, Human diseases, *Pathogens, Animal diseases, Microbiological studies, Water quality, Water analysis, Water pollution sources, Bacterial analysis, Antibiotic resistance.

Recent research in the area of detection of bacterial pathogens is cited in this review of the literature. In the area of bacterial pathogens in animals research centered on member of the genus Salmonella, on antibiotic-resistant strains and the problems they pose, on the isolation of S. typhimurium from cattle in Japan, on the distribution of members of this genus in both warm and cold blooded animals and in insects, on Leptospirosis as primarily a disease of animals but which is transmitted to humans through direct contact and indirectly by contact with a contaminated environment including water, and on surveys of the incidence of leptospirosis in animals. The detection and identification of waterborne bacterial pathogens was carried forward in research dealing with the most-

probable number procedure, with the detection and enumeration of specific pathogens to assess both the incidence of waterborne disease and the relative risk exposure of an animal or human population, and with human disease outbreaks associated with contaminated air conditioning cooling tower waters and contaminated shower heads in health care institutions. (Baker-FRC)
W83-00658

DISSOLVED-OXYGEN AND ALGAL CONDITIONS IN SELECTED LOCATIONS OF THE WILLAMETTE RIVER BASIN, OREGON,
Geological Survey, Portland, OR. Water Resources Div.
F. A. Rinella, S. W. McKenzie, and S. A. Wille.
Available from the OFSS, USGS Box 25425, Fed. Ctr. Denver, CO 80225, Price: $10.75 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 81-529, 1981. 76 p, 19 Fig, 26 Tab, 25 Ref.

Descriptors: *Dissolved oxygen, *Algae, *Water pollution, *Rivers, Water quality control, Biochemical oxygen demand, Nitrification, Solar radiation, Model studies, Sampling, Photosynthesis, *Oregon, Willamette River.

During July and August 1978, the U.S. Geological Survey, in cooperation with the Oregon Department of Enviromental Quality, made three intensive river-quality dissolved-oxygen studies in the upper Willamette River basin. Two studies were made on the upper Willamette River and one was made on the Santiam River, a Willamette River tributary. Nitrification, occurring in both the upper Willamette and South Santiam Rivers, accounted for about 62% and 92% of the DO sag in the rivers, respectively. Rates of nitrification were found to be dependent on ammonia concentrations in the rivers. Periphyton and phytoplankton algal samples were collected on the main stem Willamette River and selected tributaries during August 1978. Diatoms were the dominant group in both the periphyton and phytoplankton samples. The most common diatom genera were Melosira, Stephanodiscus, Cymbella, Achnanthes, and Nitzschia. Comparisons with historical data indicate no significant difference from previous years in the total abundance or diversity of the algae. (USGS)
W83-00696

5B. Sources Of Pollution

GENERATION OF FECAL AND TOTAL COLIFORM SURGES BY STREAM FLOW MANIPULATION IN THE ABSENCE OF NORMAL HYDROMETEOROLOGICAL STIMULI,
Leeds Univ. (England). School of Geography.
A. McDonald, D. Kay, and A. Jenkins.
Applied and Environmental Microbiology, Vol 44, No 2, p 292-300, August, 1982. 9 Fig, 20 Ref.

Descriptors: *Bacteria, *Recreation, *Reservoir releases, *England, Water quality management, Fate of pollutants, Coliforms, Thruscross Reservoir, Fewston Reservoir, River Channels, Sediments, Channel flow, Land use, Public health.

Total coliform bacteria and Escherichia coli levels increased more than 10-fold in response to reservoir releases from Thruscross Reservoir through a 3 km stream into Fewston Reservoir in north Yorkshire, England. Artificial high stages were created after rainless periods on 8 occasions from October 1979 to March 1981. Results suggest the existence of 2 stores of bacteria, one on land and one in and near the channel. The land store of bacteria is influenced by manure spreading, stock density, and other management practices and by decay processes. Transport from the land store to the channel store depends on the hill slope factors of overland flow, throughflow, and groundwater flow. The channel store of bacteria is influenced by physicochemical characteristics of the water, nutrients, bed characteristics, and time elapsed since the last transfer event. Transport from the channel to the water depends on stage and velocity changes in flow, frequency of stage and velocity changes, and channel characteristics. During an artificial release for a day's slalom canoeing on September 5, 1980, bacteria in the water increased during the rising limb of the hydrographs to 1000-10,000 per 100 ml, 10-30 times the baseflow concentration. These levels can exceed recommended guidelines for water quality in contact sports. An advisable management practice is to flush the stream before a scheduled water sports event so that bacterial levels can return to lower levels before contact occurs. (Cassar-FRC)
W83-00385

FATE OF VIRUS IN WASTEWATER APPLIED TO SLOW-INFILTRATION LAND TREATMENT SYSTEMS,
Army Medical Bioengineering Research and Development Lab., Fort Detrick, MD.
S. A. Schaub, H. T. Bausum, and G. W. Taylor.
Applied and Environmental Microbiology, Vol 44, No 2, p 383-394, August, 1982. 3 Fig, 7 Tab, 19 Ref.

Descriptors: *Land disposal, *Wastewater irrigation, *Viruses, Fate of pollutants, Wastewater disposal, Irrigation water, Spray irrigation, Infiltration, Coliphages, Polioviruses, Wastewater treatment, New Hampshire.

Primary and secondary wastewaters were applied by spray irrigation to sandy loam and silt loam soils to study the removal of seeded coliphage f2 and enteroviruses during land treatment at Hanover, New Hampshire. The f2 concentration in leachates recovered at the 170 cm level were usually below detectable levels and did not exceed 0.1% of the applied virus levels during the 53-day study period. Indigenous enteroviruses showed similar characteristics. At 10 days after seeding f2 was present throughout the soil column and tended to accumulate around the soil core at medium depths. Recoverable coliphage f2 had disappeared from the surface zone (0-2.5 cm) by days 30-31. Zones of persistence were noticeable at about 23 cm and 69-99 cm depths at the beginning, middle, and end of the test period. The adsorptive capacity of the soils for poliovirus 1 and coliphage f2 increased greatly with the soil sample depth up to a maximum at mid-depth. Better adsorption (1-3 orders of magnitude) was obtained with distilled water plus CaC12 or bottom drain percolate than with secondary sewage or 45 cm percolate. Although the results of this study support land application of wastewater to agricultural soils as an excellent treatment method, site managers should be aware that prolonged wastewater application can tie up virus adsorption sites, allowing some viruses to reach shallow groundwater. (Cassar-FRC)
W83-00386

SURVIVAL IN LAKE WATER OF KLEBSIELLA PNEUMONIAE DISCHARGED BY A PAPER MILL,
Helsinki Univ. (Finland). Dept. of Microbiology.
S. I. Niemela, and P. Vaatanen.
Applied and Environmental Microbiology, Vol 44, No 2, p 264-269, August, 1982. 3 Fig, 2 Tab, 19 Ref.

Descriptors: *Bacteria, *Pulp and paper industry, *Temperature effects, Fate of pollutants, Coliforms, Klebsiella pneumoniae, Lakes, Survival, Model studies, *Finland, Lake Lohjanjarvi, Kymi River.

The survival of Klebsiella pneumoniae was investigated at 8 temperatures from 0 to 20C in water (Lake Lohjanjarvi, Finland) receiving discharges from a paper mill. Samples were collected at distances from 1 to 5.5 km from the mill. Semilogarithmic plots of bacterial densities as a function of distance were linear, with slopes depending on water temperature. Larger slopes were produced by the higher temperatures. Regression equations were calculated for the dependence of death rate on temperature alone and on both temperature and discharge. The temperature coefficient of the death rate was 2.1 + or - 0.4. The 90% reduction time at 0C was calculated to be 24 days; at 20C, 5 days. A 10C rise in temperature approximately doubled the death rate. Observations from the Kymi River were used to verify the regression model. Predicted reduction was 23%; observed reduction was 29%. Several factors affect the reliability of the predictions including long-term variations in effluent discharge, incomplete mixing, variations in travel velocity, and variation in solar radiation. (Cassar-FRC)
W83-00387

WIDESPREAD DISTRIBUTION OF ABILITY TO OXIDIZE MANGANESE AMONG FRESHWATER BACTERIA,
Rollins Coll., Winter Park, FL. Dept. of Biology.
E. Gregory, and J. T. Staley.
Applied and Environmental Microbiology, Vol 44, No 2, p 509-511, August, 1982. 2 Tab, 10 Ref.

Descriptors: *Manganese, *Bacteria, *Oxidation, Fate of Pollutants, *Heterotrophic bacteria, Lake Washington, Seattle, *Washington, Lake Virginia, Winter Park, *Florida.

Manganese-oxidizing bacteria were enumerated in Lake Washington, Seattle, and Lake Virginia, Winter Park, Florida, on 7 occasions from June 1977 to December 1978 at depths to 57 m. The percentage of the heterotrophic population that could oxidize Mn varied throughout the year from 6 to 62% with no consistent seasonal or vertical distribution patterns. A wide variety of isolates were capable of Mn-oxidation. These included Bacillus, Caulobacter, Chromobacterium, Cytophaga, Hyphomicrobium, and Pseudomonas. All of the organisms but Bacillus lost their ability to oxidize Mn after a year of growth in the laboratory. The presence of plasmid DNA was correlated with the ability of the organism to oxidize Mn. (Cassar-FRC)
W83-00390

MEASUREMENT OF AQUATIC BIODEGRADATION RATES BY DETERMINING HETEROTROPHIC UPTAKE OF RADIOLABELED POLLUTANTS,
North Carolina Univ. at Chapel Hill. Dept. of Environmental Sciences and Engineering.
F. K. Pfaender, and G. W. Bartholomew.
Applied and Environmental Microbiology, Vol 44, No 1, p 159-164, July, 1982. 3 Fig, 3 Tab, 11 Ref.

Descriptors: *Organic compounds, *Biodegradation, *Fate of pollutants, *Trichlorobenzene, Cresol, Chlorobenzene, Nitrilotriacetic acid, Brackish water, Natural waters, Seawater, Uptake, *North Carolina.

The development and preliminary results are presented of a simple, rapid technique for measuring rates of organic pollutant biodegradation in natural aquatic samples. The method is based on the uptake and mineralization of radiolabeled pollutant substrates. The amount of substrate incorporated into cellular material and mineralized is measured and can be used to calculate metabolic velocity. The procedure was used to assess the biodegradation rates of m-cresol, chlorobenzene, nitrilotriacetic acid, and 1,2,4-trichlorobenzene in fresh, brackish, and marine water samples from the coastal areas of North Carolina. Saturation kinetics for uptake was obtained with each of the compounds tested. Rates of metabolism were dependent on sample location and time of year. (Baker-FRC)
W83-00392

FACTORS AFFECTING THE TOXIC EFFECT OF TIN ON ESTUARINE MICROORGANISMS,
Cornell Univ., Ithaca, NY. Dept. of Agronomy.
For primary bibliographic entry see Field 5C.
W83-00393

HYDROBIOLOGICAL STUDIES OF EASTERN LESSER ANTILLEAN ISLANDS VII. ST. LUCIA: BEHAVIOURAL DRIFT AND OTHER MOVEMENTS OF FRESHWATER MARSH MOLLUSCS,
Waterloo Univ. (Ontario). Dept. of Biology.
W. B. McKillop, and A. D. Harrison.
Archiv fur Hydrobiologie, Vol 94, No 1, p 53-69, April, 1982. 1 Fig, 4 Tab, 11 Ref.

Descriptors: *Mollusks, *Marshes, *Aquatic drift, Snails, Pathogens, St. Lucia, Lesser Antilles, Islands, Diurnal variation, Fate of pollutants, Biomphalaria glabrata, Pyrogophorus parvulus, Pisidium punctiferum, Invertebrates.

Behavioral and catastrophic drift of fresh water mollusks from marshes into streams was studied on the island of St. Lucia, Lesser Antilles. Pyrgophorus parvulus, Biomphalaria glabrata and Pisidium punctiferum exhibited behavioral drift. Greater numbers of mollusks drifted at night than in daytime. Rainfall disrupted the diel pattern and increased daytime drift. The smallest sizes of P. parvulus and B. glabrata drifted in higher proportions than other age groups. Drift was sufficient to maintain a population in the streams and rivers. Although the distance crawled by B. glabrata during day and night were similar, feeding activity was 9.2 times greater during the night. A high proportion of individuals burrowed into the mud during the daytime. Release of the mollusks from the stationary position was often triggered by collisions or by raindrops. Movement of these mollusks is significant because they can carry pathogenic parasites. (Cassar-FRC)
W83-00395

OBSERVATIONS ON NITRATE, PHOSPHATE AND SILICATE IN CLEVELAND BAY, NORTHERN QUEENSLAND,
James Cook University of North Queensland, Townsville (Australia). School of Biological Sciences.
For primary bibliographic entry see Field 5A.
W83-00406

PHOSPHORUS EXPORT FROM COASTAL PLAIN DRAINAGE INTO THE PEEL-HARVEY ESTUARINE SYSTEM OF WESTERN AUSTRALIA,
Western Australia Dept. of Conservation and Environment, Perth.
P. B. Birch.
Australian Journal of Marine and Freshwater Research, Vol 33, No 1, p 23-32, 1982. 8 Fig, 1 Tab, 12 Ref.

Descriptors: *Phosphorus, *Fertilizers, Agriculture, Phosphate, Water pollution sources, Water pollution effects, Coastal plains, Estuaries, Land use, Peel-Harvey Estuary, *Australia, Farming, Soil types, Rainfall, Cattle, Runoff, Water pollution control, Algae, Eutrophication.

The export of phosphorus from the rural coastal plain catchments of the Peel-Harvey estuarine system, Western Australia, was positively correlated with rates of superphosphate fertilizer application, dairy farming, and the presence of alluvial clay soils, and negatively correlated with beef farming. These relationships were determined by linear regression analyses. A total of about 4000 tons P was applied to the 9600 sq km estuary catchment in 1977-78 (an average rainfall year, 820 mm) and in 1978-79 (a low rainfall year, 650 mm). Total exports of P during these seasons were 121 and 67 tons, respectively. The P input resulted in excess growth of the benthic alga Cladophora aff. albida. P input may be decreased by reducing or modifying the present use of superphosphate fertilizers, reducing soil erosion, and reducing runoff from dairy farms. (Cassar-FRC)
W83-00408

BIOACCUMULATION OF ORGANOCHLORINES BY YEARLING COHO SALMON (ONCORHYNCHUS KISUTCH WALBAUM) FED DIETS CONTAINING GREAT LAKES' COHO SALMON, AND THE PATHOPHYSIOLOGICAL RESPONSES OF THE RECIPIENTS,
Guelph Univ. (Ontario). Dept. of Zoology.
For primary bibliographic entry see Field 5C.
W83-00418

BACTERIAL WATER QUALITY: SPRINGS AND STREAMS IN THE GREAT SMOKY MOUNTAINS NATIONAL PARK,
Great Smoky Mountains National Park, Gatlinburg, TN. Uplands Field Research Lab.
For primary bibliographic entry see Field 5A.
W83-00426

DAILY INTAKE OF LEAD, CADMIUM, COPPER, AND ZINC FROM DRINKING WATER: THE SEATTLE STUDY OF TRACE METAL EXPOSURE,
National Heart, Lung, and Blood Inst., Bethesda, MD. Epidemiology and Biometry Program.
A. R. Sharrett, A. P. Carter, R. M. Orheim, and M. Feinleib.
Environmental Research, Vol 28, No 2, p 456-475, 1982. 1 Fig, 7 Tab, 21 Ref.

Descriptors: *Metals, *Drinking water, *Plumbing, *Trace metals, Heavy metals, Lead, Cadmium, Copper, Zinc, *Seattle, *Washington, Pipes, Water consumption, Corrosive water, Fate of pollutants, Water pollution sources.

The daily intake of metals in drinking water was estimated for persons living in Seattle, a city with an unusually corrosive water supply. The mean Cu intake by an adult male working outside the home (equipped with Cu piping) was 2.2 mg per day in standing water and 1.3 mg per day in running water. The adult dietary Cu requirement is 1.5 mg per day. Mean Pb intakes for adult males working outside the home (structures less than 5 years old) were 111 micrograms per day from standing water and 31 micrograms per day from running water. The FDA adult dietary estimated Pb intake is 79.3 micrograms per day. Cd intakes were 1-2 micrograms per day from galvanized pipe homes in Seattle, much less than the adult FDA dietary estimate of 36.9 micrograms per day. Metals concentrations were closely related to type of plumbing, galvanized plumbing being associated with Zn and Cd concentrations 10 times as high as in Cu pipe homes. Cu concentration were 10 times higher in Cu pipe homes than in galvanized pipe homes. Pb concentrations tended to be 50-70% higher in Cu pipe homes than in galvanized pipe homes. In homes with mixed piping materials, trace metals concentrations were slightly different than in homes with only one type of pipe. Other factors determining concentrations of metals in drinking water considered in the study were length of pipe between house shut-off valve and tap, age of house, type of service line, length and type of pipe between meter and main, and water supply source (Tolt or Cedar River). The determinants of Cu, Pb, Zn, and Cd concentrations in the drinking water were summarized. In calculating daily intakes the age and sex of the persons and their water consumption were considered. (Cassar-FRC)
W83-00431

PHTHALATE ESTER CONCENTRATION VARIATIONS IN DATED SEDIMENT CORES FROM THE CHESAPEAKE BAY,
Ecole Polytechnique, Palaiseau (France). Lab. de Chemie Analytique Physique.
J. C. Peterson, and D. H. Freeman.
Environmental Science and Technology, Vol 16, No 8, p 464-469, August, 1982. 7 Fig, 2 Tab, 31 Ref.

Descriptors: *Phthalates, Organic compounds, *Chemical wastes, Pollutant identification, *Sediment cores, *Chesapeake Bay, Estuaries, Water pollution sources, Tracer studies, Esters.

Concentrations of seven phthalate esters were determined in sections of two Chesapeake Bay sediment cores dating back to 1842. The limitations of small sample sizes and ppb levels were overcome by use of gas chromatography/mass spectrometry. All phthalate esters increased in concentration toward the sediment surface. The greatest increase was seen in bis(2-ethylhexyl) phthalate (DEHP), first synthesized in 1933. Its production rate and its accumulation rate in the sediments were closely correlated. In the core taken from sediments more impacted by the industries of Baltimore, DEHP concentrations were 20-29 ppb in the 1923-52 layer, 124 ppb in the 1963-68 layer, and 180 ppb in the 1974-79 layer. The core taken further south near the mouth of the Potomac River contained < 2.6 ppb DEHP in the 1924-32 layer and 12 ppb in the 1972-79 layer. Low levels of phthalates were found in layers predating their initial production. The most likely explanation for this phenomenon is bioperturbation by burrowing fauna. If DEHP production continues at its annual 6% increasing rate, pollution by this ester will double in 12 years. Since the production rate of DEHP, the production rate of total synthetic chemicals, and the profile of DEHP pollution closely parallel each other, this compound may be a useful indicator for mixed synthetic organic chemical concentrations in sediments. (Cassar-FRC)
W83-00434

HALOCARBONS AS TRACER SUBSTANCES IN STUDIES OF THE DISTRIBUTION PATTERNS OF CHLORINATED WATERS IN COASTAL AREAS,
Goeteborg Univ. (Sweden); and Chalmers Univ. of Tech., Goeteborg (Sweden). Dept. of Analytical and Marine Chemistry.
E. Fogelqvist, B. Josefsson, and C. Roos.
Environmental Science and Technology, Vol 16, No 8, p 479-482, August, 1982. 6 Fig, 15 Ref.

Descriptors: *Pulp wastes, *Cooling waters, *Chlorinated hydrocarbons, Tracers, *Pollutant identification, *Path of pollutants, Chloroform, Bromoform, Effluents, Bleaching wastes, Powerplants, Nuclear powerplants, Chlorination, Water treatment, Seawater, Coastal waters, Plumes, Monitoring, Distribution patterns, *Sweden.

The movements of effluent plumes in seawater off the Swedish coast were followed using haloforms produced in the chlorination process. Tracer substances used to define the plume included chloroform, produced from bleaching pulp wastes at a mill, and bromoform, produced by disinfection of cooling seawater at a nuclear powerplant. The analytical method used pentane extraction of 100 ml samples, followed by glass capillary gas chromatography with electron capture detection. The bleaching effluent contained 93 micrograms per liter chloroform when measured in June 1979. Isopleths were constructed for the concentrations at the 15 m depth, 9 micrograms per liter being the maximum concentration at the outfall. The powerplant effluent contained 100 micrograms per liter bromoform. Depth profiles showed that layers of bromoform concentration were formed, one at 6 m depth (powerplant origin) and one at 12-15 m depth (biogenic origin). This method is simple and rapid, permitting analysis of plumes before winds and currents disturb the patterns. (Cassar-FRC)
W83-00435

KEPONE DISTRIBUTION IN SELECTED TISSUES OF BLUE CRABS, CALLINECTES SAPIDUS, COLLECTED FROM THE JAMES RIVER AND LOWER CHESAPEAKE BAY,
William and Mary Coll., Gloucester Point, VA. Inst. of Marine Science.
M. H. Roberts, Jr.
Estuaries, Vol 4, No 4, p 313-320, December, 1981. 6 Fig, 4 Tab, 18 Ref.

Descriptors: *Crabs, *Insecticides, *Bioaccumulation, *Fate of pollutants, *Kepone, Chlorinated hydrocarbons, James River, *Virginia, Chesapeake Bay, Accumulation.

The Kepone concentrations in blue crab (Callinectes sapidus) muscle, gonad, and hepatopancreas tissue were determined in crabs collected in June, July, and August 1978 from 7 stations in the lower Chesapeake Bay and lower James River, Virginia. Median Kepone levels were 0.05 micrograms per g or less (considered uncontaminated) in all samples of crabs from the lower bay. In the lower James River concentrations of Kepone were higher. Maximum median Kepone concentrations (in micrograms per g) were: ovigerous females, 0.20 in backfin (BF) tissue, 0.10 in hepatopancreas (HP) tissue, and 0.25 in gonad (GO) tissue; nonovigerous females, 0.06 in BF, 0.40 in HP, and 1.12 in GO; males, 0.45 in BF, 0.18 in HP, and 0.32 in GO. (Cassar-FRC)
W83-00436

DESORPTION OF RU106, CS134, CS137, CE144 AND AM241 FROM INTERTIDAL SEDIMENT CONTAMINATED BY NUCLEAR FUEL REPROCESSING EFFLUENTS,
JRC, Varese (Italy). Radiochemistry Div.
D. A. Stanners, and S. R. Aston.
Estuarine, Coastal and Shelf Science, Vol 14, No 6, p 687-691, 1982. 1 Fig, 1 Tab, 17 Ref.

Descriptors: *Sediments, *Radioisotopes, *Adsorption, Fate of pollutants, Rubidium radioisotopes, Cesium radioisotopes, Cerium radioisotopes, Americium radioisotopes, Marine sediments, Estuaries, Fuel reprocessing, *Nuclear wastes, Ravenglass Estuary, Windscale plant, Irish Sea, *England, *Desorption, Interstitial areas.

Desorption of radionuclides from estuarine sediments impacted by the Windscale fuel reprocessing plant at the Ravenglass Estuary, England, was investigated in the laboratory. Desorption of Am241, Ce144, and Ru106 was negligible over a 10-day period. However, Cs134 and Cs137 were desorbed up to 30% of their original activity. In spite of the identical chemical properties of Cs134 and Cs137 the Cs134 was preferentially lost. This may be explained by the long-term irreversible fixing of the longer-lived Cs137 into the sediment. (Cassar-FRC)
W83-00437

POLLUTION FROM US EXPLOSIVES AND PROPELLANTS PRODUCTION,
For primary bibliographic entry see Field 5D.
W83-00441

THE CONCENTRATION, REACTIVITY AND FATE OF COPPER, NICKEL AND ZINC ASSOCIATED WITH A COOLING-WATER PLUME IN ESTUARINE WATERS,
Connecticut Univ., Groton. Dept. of Marine Sciences.
D. G. Waslenchuk.
Environmental Pollution, Series B, Vol 3, No 4, p 271-287, 1982. 4 Fig, 6 Tab, 8 Ref.

Descriptors: Metals, *Cooling water, *Thermal pollution, Water pollution sources, Fate of pollutants, Heavy metals, *Copper, *Nickel, *Zinc, Powerplants, Millstone Nuclear Power Station, Waterford, *Connecticut, Long Island Sound, Plumes, Corrosion, Adsorption, Pipes, Estuaries, *Nuclear powerplants.

Saline water from Niantic Bay passing through the once-through cooling system at the Millstone Nuclear Power Station, Waterford, Connecticut, was a source of dissolved and particulate Cu, Ni, and Zn in the receiving waters of Long Island Sound. Dissolved metals levels (micrograms per kg) in Long Island Sound waters far from the plant were: Cu, 1.2; Ni, 1.0; and Zn, 1.4 at a temperature of 16.75C. In the cooling water discharge metals levels (in micrograms per kg) were: Cu, 2.3; Ni, 3.5; and Zn, 1.5 at a temperature of 31.5C. Total metal concentrations (in micrograms per kg) including particulates dislodged from the piping were: Cu, 4.7; Zn, 3.1; and Ni, uncertain. As the discharge plume was diluted, some particulate Cu and Zn dissolved, adding to the dissolved fraction. However, dissolved Ni appeared to decrease in concentration in the plume, possible a result of adsorption to suspended matter. (Cassar-FRC)
W83-00443

CHLOROBENZENES IN SEDIMENTS, WATER, AND SELECTED FISH FROM LAKES SUPERIOR, HURON, ERIE, AND ONTARIO,
Canada Center for Inland Waters, Burlington (Ontario).
B. G. Oliver, and K. D. Nicol.
Environmental Science and Technology, Vol 16, No 8, p 532-536, August, 1982. 2 Fig, 5 Tab, 19 Ref.

Descriptors: *Chlorinated hydrocarbons, *Lakes, *Sediments, Fate of pollutants, Pollutant identification, Water analysis, *Chlorobenzenes, Organic compounds, Fish, Trout, Lake sediments, *Great Lakes, Lake Superior, Lake Huron, Lake Erie, Lake Ontario, Niagara River, Grand River, Effluents, Water pollution sources.

Concentrations of chlorobenzenes were determined in sediments, water, and fish from several Great Lakes; in water from the Grand and Niagara Rivers; in effluents from 4 sewage treatment plants; and in drinking water from 3 water treatment plants. Values are given for each of 11 chlorobenzene compounds from di- to hexa-substituted. Total mean levels of chlorobenzenes (in parts per trillion) in water samples were low: 51 in Lake Ontario, 4 in Lake Huron, 20 in drinking water, 19 in the Grand River, and 706 in wastewater effluents. Estimated removal of chlorobenzenes in the activated sludge process was 75-95%. In sediments the sum of the dichloro- through hexachlorobenzenes (HCB) was 10 ppb in Lake Superior, 26 ppb in Lake Erie, 38 ppb in Lake Huron, and 560 ppb in Lake Ontario. In Lake Ontario some unusual chlorobenzenes, involved in the manufacture of pesticides, were prevalent. Analysis of 1 cm sections of a Lake Ontario sediment core dating back to 1923 indicated that most HCB and other chlorobenzene inputs started about 1944. Trout from Lake Ontario contained markedly higher chlorobenzene levels (on the order of 100 ppb) than trout from the other lakes (< 35 ppb). Suspected major sources of chlorobenzene loading to Lake Ontario were waste disposal leachates and chemical manufacturing effluents. Many of these facilities are located in the Niagara Falls, New York, area. The source of the much smaller levels of chlorobenzenes in the other lakes was probably wastewater treatment plant effluents. (Cassar-FRC)
W83-00444

FATE OF FENITROTHION IN AQUATIC MICROCOSMS AND THE ROLE OF AQUATIC PLANTS,
Ottawa Univ. (Ontario). Dept. of Biology.
P. Weinberger, R. Greenhalgh, R. P. Moody, and B. Boulton.
Environmental Science and Technology, Vol 16, No 8, p 470-473, August, 1982. 6 Fig, 1 Tab, 19 Ref.

Descriptors: *Insecticides, *Aquatic plants, *Degradation, *Fenitrothion, Pesticides, Macrophytes, Algae, Sediment, Lac Bourgeois, *Quebec, *Fate of pollutants, Lakes, *Ontario.

The fate of a fenitrothion formulation (concentration in water, 10 ppm) was monitored in laboratory and field experiments under both light and dark conditions. The microcosms were constructed with water, sediment, and aquatic macrophytes to simulate the proportions found in eastern Ontario and western Quebec lakes. In all systems uptake and degradation of fenitrothion was more rapid in light than in dark. Degradation products were fenitrooxon, demethylfenitrothion, S-methylfenitrothion, carboxyfenitrothion, 3-methyl-4-nitrophenol, and a new degradation product, carboxyaminofenitrothion. In the dark only hydrolysis products were found. In the water/algae system (Chlorella and Chlamydomonas) fenitrothion uptake was virtually complete in 4 hours; the bioconcentration factor (BCF) was 417. In the water/plant system Elodea densa absorbed most of the fenitrothion within 2 day. The BCF was 76 and 24 for light and dark systems respectively, after 1 day. For a water/plant system containing Myriophyllum, Elodea, and Sagittaria (1:1:1 ratio) fenitrothion was rapidly adsorbed. Bioconcentration factors after 5 days were 370-488 for the 3 plants. Different derivatives were predominant in different plants. In the field tests the main sink was the sediment. Analysis of the degradation products in the systems indicates that uptake and degradation of fenitrothion in water is photocatalyzed and is oxidative. (Cassar-FRC)
W83-00448

ACCUMULATION BY FISH OF CONTAMINANTS RELEASED FROM DREDGED SEDIMENTS,
Bureau of Commercial Fisheries, Ann Arbor, MI. Great Lakes Fishery Lab.
J. G. Seelye, R. J. Hesselberg, and M. J. Mac.
Environmental Science and Technology, Vol 16, No 8, p 459-464, August, 1982. 1 Fig, 7 Tab, 12 Ref.

Descriptors: Fish, Dredging, *Bioassay, *Perch, Sediments, *Bioaccumulation, Accumulation, Fate of pollutants, Metals, Pesticides, *Polychlorinated biphenyls, Suspended sediments, Great Lakes.

Three experiments were used to study the accumulation of pollutants from 10 days exposure of yellow perch (Perca flavescens) to dredged sediments: (1) fish of hatchery and lake origin exposed to a suspension of nonaerated sediments, (2) fish of hatchery origin exposed to a suspension of nonaerated sediment, and (3) fish of hatchery origin exposed to a suspension of aerated sediment. Sediments obtained from Saginaw Bay contained polychlorinated biphenyls (PCBs), DDT, and metals. In experiment (1) hatchery fish had significantly higher concentrations of PCBs and Fe and significantly lower concentrations of Sb than control fish. Lake fish had significantly higher concentrations of As, Na, Cr, and Fe than control fish. In experiment (2) PCBs and Hg were higher in exposed than in control fish. In experiment (3) PCB's, DDE, Zn, Fe, Cs, and Se were significantly higher in exposed fish than in control fish. These results show that certain pollutants, especially PCBs, are readily and directly accumulated from resuspended sediments by fish. In addition, several recommendations for designing bioaccumulation tests were developed. Fish should be consistent with respect to size and origin. Sediments should be consistently handled with respect to oxidation-reduction and amount of sediment used. Water in tests should have the same hardness and salinity as water at the proposed dredging site (accumulation of metals is usually lower in hard water than in soft water). Bioaccumulation tests should be conducted for longer than 10 days where long-term impacts are important. (Cassar-FRC)
W83-00449

EVALUATING THE POTENTIAL FOR CONTAMINATING DRINKING WATER FROM THE CORROSION OF TIN-ANTIMONY SOLDER,
Herrera Environmental Consultants, Seattle, WA.
C. E. Herrera, J. F. Ferguson, and M. W. Benjamin.
Journal of the American Water Works Association, Vol 74, No 7, p 10, 368-375, July, 1982. 9 Fig, 8 Tab, 12 Ref.

Descriptors: *Drinking water, *Metals, *Plumbing, Pipes, Lead, Water pollution sources, Tin, Antimony, Water conveyance, Potable water, Tin oxide, *Corrosion.

A significant health hazard can arise to the public due to the corrosion of lead-based solders in plumbing. The replacement of lead-based solder with tin-antimony solder will remove the lead from potable water; however, the full significance of antimony in water is not at present known. Both theoretical and experimental evidence is presented for the effects of tin-antimony solder in corrosive water. The theoretical investigation of antimony corrosion, tin corrosion, and galvanic coupling relationships indicates that the leaching of antimony from solder may be inhibited by two mechanisms. The galvanic coupling relationships among tin, antimony, and copper indicate that the corrosion of tin is theoretically more favorable than that of antimony, so that tin may act as a sacrificial anode. Secondly, tin can be passivated by tin oxide, and the passivating film may also cover the antimony contained in solder, thereby inhibiting antimony corrosion. Experimental results indicate that 95-5 tin-antimony solder has excellent potential for replacing lead-based solders in private and commercial plubing systems. The increase of antimony in the drinking water appeared minimal, probably due to the sacrficial corrosion of tin and the formation of tin oxide. (Baker-FRC)
W83-00452

EFFECT OF INDUSTRIAL-RESIDENTIAL ZONES ON WATER QUALITY OF SURFACE STREAMS,
L. I. Aleksinskaya, V. M. Borishanskii, Y. E. Saet, and T. N. Filina.
Water Resources, Vol 8, No 4, p 409-415, July/August, 1981. 4 Tab, 4 Ref. Translated from Vodnye Resursy, No 4, p 118-125, July/August, 1981.

Descriptors: *Industrial wastewater, *Metals, *Sediments, Water pollution sources, Fate of pollutants, Water pollution prevention, Heavy metals, Suspended sediments, Wastewater treatment, Trace metals, Settling basins, Inorganic compounds, Suspended solids, *USSR.

The quality of surface waters in 2 industrial-residential zones in the USSR was compared. Emphasis was on inorganic constituents. Labeled Zone Y and Zone X, the 2 drainage areas were similar in area, stream discharges, wastewater treatment (open settling ponds), and total numbers of industrial workers. In Zone Y the predominant industrial activities were machining of nonferrous metals, construction, and petroleum refining. In Zone X the manufacturing was concentrated on electronics (using nonferrous and rare metals) and textile and dyeing industries. Stream water from both zones was higher than background levels in pH, 2 times the total mineralization, 10-14 times higher in ammonium, 2-2.5 times higher in sulfate, and 3-3.5 times higher in ferric ion. Zone Y had 13 times higher turbidity levels, 150 times higher nitrates, and 60 times higher ferrous ion than background levels. Zone X had 20 times higher turbidity, 109 times higher nitrate, and 120 times higher ferrous ion than background levels. Concentration factors for elements in suspended solids of stream water in Zone Y were: Cd, V, Hg, all 1; Ni, 2; Cr, 4; Sn, > 4; Mo, 5; Ti, 6; Zn, 9; W, > 9; La, > 17; Ag, 18, and Cu, 63; for Zone X: W and Sn, 2; Cr, 2.5; Cu, 4; Ni, >4; La, 8; Mo, Ti, and Hg, > 10-12; Zn, 19; V, 21; Ag, > 75, and Cd, > 1400. The water soluble phase of the streams contained a similar complex of elements. These factors reflect the type of industry predominating in each zone: Cd, Ag, Hg, Ni, and Zn in electronics; V and Ti in textiles; Cr and W in structural steels; and Cu in electrical engineering. The treatment plant settling ponds in Zone Y retain most of the polluting elements, but in Zone X most are carried into the receiving stream. It was suggested that the high metals contents of the industrial wastewaters be reduced by pretreatment at the plants. The contaminated suspended material should also be removed by settling ponds at the plants or at the municipal treatment plant. Water quality can also be improved by aeration and oxidation of reduced complexes (Fe, Mn, and organics). (Cassar-FRC)
W83-00460

THE CHARACTER AND DISPERSAL OF MOTORWAY RUN-OFF WATER,
Victoria Univ. of Manchester (England). Pollution Research Unit.
E. G. Bellinger, A. D. Jones, and J. Tinker.
Water Pollution Control, Vol 81, No 3, p 372-390, 1982. 7 Fig, 6 Tab, 49 Ref.

Descriptors: *Highways, *Storm water, *Deicers, Water pollution sources, Fate of pollutants, Roads, Sodium, Chlorides, Nitrates, Runoff, Rainstorms, Water quality, Suspended sediments, Groundwater pollution.

Surface water runoff and sediment deposits from a 680 m stretch of the Blackpool Link section of a motorway in England were monitored after selected rainstorms from January 1976 to December 1977. Peak monthly concentrations of Na, Mg, Ca, nitrate, sulfate, and Cl were highest during winter, reflecting the use of road deicing salts. Residence time of rock salt on the road surface was less than 3 weeks. Routine analysis of groundwater samples in the aquifer beneath a brook receiving runoff showed increases in Ca, Mg, Cl, nitrate, and sulfate starting a few months before the official opening to traffic in July 1975. Sediment particle size was well-graded in the 0.1-2 mm size range (medium and coarse sand). Chemical analysis of suspended solids showed an association of chemical ions with the smaller sediment particles. Concentrations of ions (mg per liter) during non-salting periods were: K and Mg, < 5; Ca, 30-100; Na, 12-37; sulfate, 6-100; Cl, 22-75; and nitrate, 1.95-73.5. Nitrate was not affected by road salting but was influenced by farming activities. However, maximum concentrations (mg per liter) of the other ions were reached during salt application: K, 47; Mg, 42; Ca, 820; Na, 20,000; and Cl, 37,500. The first flush from a storm usually contained the highest levels of pollutants. The pollutant load was a function of antecedent dry days and quantity of rainfall. Pollution loads (in kg) per storm discharged into the receiving stream were: Na, 0.064-1025; K, 0.017-0.967; Ca, 0.087-21.02; Mg, 0.013-1.833; sulfate, 0.039-20.85; nitrate, 0.058-1.18; chloride, 0.83-11.95 and suspended solids, 0.06-43.65. Storm runoff contributed up to 78% of ionic contaminants and up to 48% of the suspended solids leaving the roadway and entering the brook. An undetermined amount of polluted road water was dispersed to the atmosphere as dry particles or spray. (Cassar-FRC)
W83-00461

MIXING AND TRANSPORT,
Georgia Inst. of Tech., Atlanta. School of Civil Engineering.
P. J. W. Roberts.
Journal of the Water Pollution Control Federation, (Literature Review Issue), Vol 54, No 6, p 763-769, June, 1982. 110 Ref.

Descriptors: *Mixing, *Transport, *Literature review, *Model studies, Streams, Rivers, Lakes, Reservoirs, Cooling ponds, Estuaries, Salt marshes, Coastal waters, Water currents, Current meters, Jets, Plumes, Stratified flow, Stratification, Fluid mechanics, Weather, Wind, Temperature, Path of pollutants.

A review of literature concerning various aspects of pollutant mixing and transport is presented. Streams and rivers were studied by means of models, including cells-in-series and advective-dispersion models applied to an observed release of dye into the Mississippi River, a new delay-difusion equation used for the calculation of logitudinal dispersion, analysis of contaminant dispersion by the ray method, a turbulence closure model, and a BOD model for dissolved oxygen in streams. One-, two-, and three-dimensional models were used by various authors to simulate conditions in lakes and reservoirs, while other papers discussed the effects of wind and temperature on transport and mixing in lakes and the design and flow and temperature distributions in cooling ponds. Three comprehensive papers covered the use and development of physical models of estuary processes, while one-dimensional models of estuarine transport predictions were studied in several works and two-dimensional models were used occasionally. The influences of turbulence and weather on estuarine transport were also covered. Studies in coastal waters included current meter and other field observations, as well as the influence of wind and other weather conditions on currents and circulation. Studies of jets and plumes covered non-buoyant jets issuing perpendicular to an ambient flow, laminar and turbulent round buoyant jets, three-dimensional buoyant jets,and thermal plumes. Stratified fluids were discussed in several model studies including models of the hydrodynamics of shallow, buoyant surface layers; of the deepening of a surface wind mixed layer in a stratified fluid; and an expression for the vertical velocity profile in stably-stratified two-dimensional channel flows. A review of publications on fluid mechanics principles relating to ecological problems and a comment on relationships between fluid mechanics and environmental issues were cited. (Gish-FRC)
W83-00478

NON-POINT SOURCES,
Browne (F. X.) Associates, Inc., Lansdale, PA.
F. X. Browne, J. B. Orr, T. J. Grizzard, and B. L. Weand.
Journal of the Water Pollution Control Federation (Literature Review Issue), Vol 54, No 6, p 755-763, June 1982. 132 Ref.

Descriptors: *Nonpoint pollution sources, *Literature review, *Water pollution sources, *Water pollution control, Water management, Water sampling, Watersheds, Runoff, Agricultural runoff, Storm runoff, Urban runoff, Nutrients, Agriculture, Metals, Water quality, Model studies, Acid rain.

Recent publications concerning non-point sources of water pollution are reviewed. General aspects of the topic, such as water quality sampling networks and water pollution network models, are mentioned. Publications on the analysis and characteristics of non-point sources cover the sampling efficiency of the Coshocton Wheel; measurements of water-quality indicators such as suspended iron and lead, fecal coliforms, nitrogen, phosphorus, and potassium in watershed areas; the effects of canopies of corn, oats, and soybeans on the nutrient content of precipitation; the impact of wastewater sludge application to a watershed on metal content in runoff, groundwater, and soil; and urban non-point runoff. Water quality effects are discussed in studies of the fate of trace metals in a river-reservoir system, nutrient yields in runoff from small urban catchments, and phosphorus and chloride concentrations in runoff, streams, and lakes. Watershed studies also focus on nutrient levels but include works on suspended-sediment load, sediment runoff from river catchment areas, and trace metal mobility. Non-point source model research included a continuous simulation model applied to the Des Moines River, a modification of the SCS 'TR-20' runoff model for predictions of suspended sediment and bound-ion loadings, storage/tre to agricultural runoff. Non-point source management topics include local programs to manage storm water, urban and agricultural non-point pollution controls, water pollution control through river basin administration and financing agencies, and the effects of devices such as vegetative filters and concrete grids on runoff. Finally, papers on acid precipitation emphasize the altering of the chemistry and biology of streams and lakes and growth-limiting effects on plants. (Gish-FRC)
W83-00479

EVALUATION OF THE RIVER DIE-AWAY BIODEGRADATION TEST,
Missouri Univ.-Columbia. Dept. of Fisheries and Wildlife.
G. D. Wylie, J. R. Jones, and B. T. Johnson.
Journal of the Water Pollution Control Federation, Vol 54, No 8, p 1231-1236, August, 1982. 6 Fig, 1 Tab, 28 Ref.

Descriptors: Degradation, *Variability, *Phthalates, Organic compounds, Fate of pollutants, Di-2-ethylhexyl phthalate, Phthalic acid, *Biodegradation, *River Die-away Test, Rivers, *Missouri River, Suspended solids.

The river die-away (RDA) test for evaluating the biodegradability of chemicals in water was tested using labeled di-2-ethylhexyl phthalate (DEHP) and phthalic acid in Missouri River water. Test results were too variable and too dependent on laboratory conditions to reliably apply to the aquatic environment. Jars with river water (filtered and unfiltered) containing the compounds were allowed to stand in the dark on a laboratory bench top for 4 consecutive 35-day periods. Biodegradation of unfiltered DEHP was 11-78%; filtered DEHP, 4-28%. Biodegradation of phthalic acid was 66-92%. DEHP degradation was directly related to initial suspended solids but not to bacterial biomass or nutrient concentrations. (Cassar-FRC)
W83-00492

CONTAMINATION OF A GLACIAL AQUIFER AT PEASE AIR FORCE BASE, PORTSMOUTH, NEW HAMPSHIRE,
Geological Survey, Boston, MA.
E. Bradley.
Journal of the New England Water Works Association, Vol 96, No 2, p 109-126, 1982. 6 Fig, 1 Tab, 3 Ref.

Descriptors: *Solvents, *Groundwater pollution, *Storm drains, Path of pollutants, Fate of pollutants, *Trichloroethylene, Organic compounds,

Aquifers, Pease Air Force Base, Portsmouth, *New Hampshire, Wells, Water supply, Groundwater movement, Plumes, Tanks, Drains, Water pollution sources.

Trichloroethylene (TCE) at levels hazardous to health was detected in the groundwater supply of Pease Air Force Base, New Hampshire, in April 1977. This study was designed to identify the contaminating hydrocarbons and to define the nature, behavior, and extent of the contamination. TCE, used in large quantities at the base before 1973, was disposed of by storage in underground tanks, by burning, and by burial in landfills. In analysis of water samples collected June 1977 to May 1978, Haven well had the highest TCE concentrations, 40 to almost 400 micrograms per liter; ditch samples contained up to 60 micrograms per liter. Water sampling in the Haven well vicinity indicated that the contamination originated upgradient (northward) of the well. The precise pollution source was not determined but could have been any of the point sources or spills on ground and parking aprons and near storm drains. Scum within certain storm drains contained very high levels of TCE, suggesting that TCE concentrations in the northeast storm drain had been very high in the past. Some TCE contaminated groundwater has been recirculated by pumping from the Haven well and flow of the used water into storm drains. It was suggested that the Haven well should continue to be pumped, treating some of the water for consumption and using untreated water for aircraft washing. To close the Haven well would create a water supply problem and possibly allow migration of TCE contaminated groundwater to the unaffected wells further south. (Cassar-FRC)
W83-00495

GROUND-WATER POLLUTION INVESTIGATIONS IN THE GREAT OUSE BASIN. II-SOLID WASTE DISPOSAL,
D. J. Tester, and R. J. Harker.
Water Pollution Control, Vol 81, No 3, p 308-328, 1982. 5 Fig, 5 Tab, 27 Ref.

Descriptors: *Leachates, *Waste disposal, *Groundwater pollution, Landfills, Fate of pollutants, Organic compounds, Trace levels, Water pollution sources, Plumes, Legislation, Permits, Solid waste disposal, *Great Ouse Basin, *England.

The United Kingdom DOE's relaxation of requirements for permitting hazardous waste in landfills was welcomed by waste disposal authorities and guardedly received by water authorities. An investigation of groundwater quality at 3 domestic refuse sites strengthened the new approach by showing that pollution plumes around domestic landfills are restricted in extent and that attenuating mechanisms ameliorate the effects of leachate on groundwater quality, even where no substantial unsaturated zone exists. Although low levels of 66 organic micropollutants were detected in groundwater, they were not considered hazardous. Maximum levels of any single pollutant were estimated at 100 micrograms per liter; most were an order of magnitude lower. (Cassar-FRC)
W83-00507

THE RESORPTION OF ZINC FROM SCALES OF SEA TROUT (SALMO TRUTTA) DURING THE UPSTREAM SPAWNING MIGRATION,
Liverpool Univ. (England). Dept. of Zoology.
K. T. O'Grady.
Freshwater Biology, Vol 11, No 6, p 561-565, December, 1981. 1 Tab, 17 Ref.

Descriptors: *Fish, *Trace metals, *Water pollution effects, Zinc, Iron, Estuaries, Estuarine environment.

Zinc concentrations in the scales of unripe, premigratory sea trout and ripe, post-migratory sea trout about to spawn were compared to find out if the utilization of stored zinc that occurred in Oncorhynchus nerka also occurred in Salmo trutta. The age range, mean length and mean weight of the sea trout sampled were listed. No correlation was found between scale trace metal concentrations and the length, weight or age of the sea trout. The estuarine sea trout sampled in the study were heavier and longer than those from fresh water. Zinc was detected in all scale samples, and scales of sea trout from three sites in fresh water had similar mean values which were not significantly different from each other. Iron was not always detected in the scales, particularly in those from sea trout caught in fresh water, and the concentrations found were more variable than the zinc values. The concentration in scales from sea trout caught in freshwater was lower than in those caught in the estuary. The reclamation of trace metals from scales may represent the withdrawal of stored nutrients from body reserves to be used in gonad development and maturation. (Baker-FRC)
W83-00511

CONVECTION IN BOTTOM SEDIMENTS AND ITS ROLE IN MATERIAL EXCHANGE BETWEEN WATER AND SEDIMENTS,
Water Protection Association of Savo, Kuopio (Finland).
K. M. Lappalainen.
Hydrobiologia, Vol 86, No 1/2, p 105-108. January, 1982. 4 Fig, 3 Ref.

Descriptors: *Heat transfer, *Convection, *Sediments, Temperature, Water temperature, Lake sediments, Lakes, Fate of pollutants, Lake Kallavesi, Sammakkolampi, *Finland, Stratification, Thermal stratification, Interstitial water, Mass transfer, Eutrophic lakes, Littoral zone.

Temperature profiles of lake bottom sediments were measured in a small eutrophic pond, Sammokkolampi, and a large lake, Kallavesi, both in Finland. The constant deep sediment temperature, +6C, was reached at a depth of 2 m. The thermal stratification pattern in sediment was similar to that in water. Thermal gradients and seasonal variations of temperature were much greater in littoral sediments than in profundal sediments. Convection currents in the sediments were most prevalent during spring and summer overturn when the density of overlying water was less than that of the interstitial water. Some convection was noticeable in winter. Duration and magnititude of convection depended on warming and cooling rates. These currents may be important in transfer of pollutants and other substances from the sediments to the water. (Cassar-FRC)
W83-00531

HYDROLOGIC EFFECTS ON HIGHWAY-DEICING CHEMICALS IN MASSACHUSETTS,
Geological Survey, Boston, MA. Water Resources Div.
L. R. Frost, Jr., S. J. Pollock, and R. F. Wakelee.
Available from the OFSS, USGS Box 25425, Fed. Ctr. Denver, CO 80225, Price: $8.00 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 81-209, 1981. 56 p, 26 Fig, 12 Tab, 26 Ref.

Descriptors: *Highways, *Deicers, *Sodium chloride, *Surface runoff, *Water quality, Path of pollutants, Infiltration, Solute transport, Drainage systems, Flow separation, Groundwater recharge, Specific conductivity, Data collections, Hydrologic models, Regression analysis, *Massachusetts, Highway deicing chemicals.

Methods of estimating annual mean and annual maximum chloride concentrations and sodium concentrations in streams were developed using multiple and simple linear regression techniques and data collected during the 1972-77 water years. Independent variables are easily obtainable parameters such as total salt application within a basin, annual precipitation, and drainage basin characteristics. Methods for obtaining gross estimates of chloride loads and sodium loads from salt-application data and estimates of nonhighway-related chloride and sodium were suggested. A chloride budget was calculated for a small drainage basin containing a section of interstate highway. The chloride budget was described in terms of the percentages in direct runoff to the stream, in ground-water discharges to the stream, in storage in the ground, and in the amount unaccounted for. Attempts were made to relate chloride concentrations in ground water adjacent to highways to quantities of salt applied to the highways on an annual basis, annual precipitation, depth of the wells below land surface, depth of wells below the water table, and distance of well from edge of pavement. Little correlation was observed between annual salt-application values and annual mean chloride concentrations in ground water near highways. The irregular distribution of highway runoff, due to topographic differences between sites, and variations in salting and runoff during individual storm events seem to affect correlation between quantities of salt applied and chloride concentrations in ground water near highways. (USGS)
W83-00558

LOW FLOW WATER CHEMISTRY IN FORESTED AND PASTURE CATCHMENTS, MAWHERAITI RIVER, WESTLAND,
Forest Research Inst., Christchurch (New Zealand).
M. P. Mosley, and L. K. Rowe.
New Zealand Journal of Marine and Freshwater Research, Vol 15, No 3, p 307-320, 1981. 5 Fig, 7 Tab, 42 Ref.

Descriptors: *Water analysis, *Rivers, Mawheraiti River, *New Zealand, Chemical analysis, Incineration, Stream flow, Calcium, Magnesium, Sodium, Potassium, Nitrates, Phosphates, Ammonium, Trace metals, Catchments, Forest watershed, Water quality, Forest management, Water pollution sources.

Water chemistry was investigated at a number of locations in the Mawheraiti River catchment in Westland, South Island, New Zealand. Subcatchment areas range up to 78 square kilometers, and land cover includes indigenous forests, pasture and scrub. Variations were noted in water chemistry which may be related to season, discharge, lithology and land use. However, perhaps the most striking feature of the low flow water chemistry of the river was its purity. Total solute concentrations, determined by evaporation to dryness, exceeded 50 mg/liter in only a few water samples, and perhaps 15 mg/liter of this could have been non-filterable organic colloidal matter. Irrespective of land use or management, under low flow conditions concentrations of individual ions did not approach the safe limits for human or animal consumption, except for limited periods immediately after slash-burning in a clearfelled catchment. In particular, nitrate and phosphate, the nutrients that are usually considered to cause water quality problems, were generally below 0.05 mg/liter. Greater concentrations in catchments subjected to clearfelling and slash-burning were rapidly diluted downstream. (Baker-FRC)
W83-00568

THE MAIN APPROACHES TO THE STUDY OF THE CYCLE OF BIOLOGICAL ELEMENTS IN THE DNIEPER RESERVOIRS,
Akademiya Nauk URSR, Kiev Inst. Hidrobiologii.
A. I. Denisova, and Ye. P. Nakhshina.
Hydrobiological Journal, Vol 17, No 2, p 94, 1981.

Descriptors: *Nutrients, *Bottom sediments, *Metals, Fate of pollutants, Dnieper River, *USSR, Trace metals, Chemical reactions, Sediments, Lake sediments, Self-purification, Water pollution sources.

Studies of the fate of nutrients and trace metals in the reservoirs of the Dnieper chain consider all factors, both allochthonous and autochthonous. Some of these factors are the position of the reservoir in the chain, its age, its morphology, anthropogenic input, the role of suspended matter and bottom sediments, and higher water plants. Bottom sediments play an important role in the fate of metals and nutrients. In some cases they promote self-purification; in others they are a source of pollution through resuspension and chemical reactions (oxidation-reduction and complex formation). (Cassar-FRC)
W83-00599

BIODEGRADATION OF CELLULOSE IN BOTTOM SEDIMENTS OF LAKE BAIKAL,

Irkutskii Gosudarstvennyi Univ. (USSR). Lake Baikal Biological Station.
E. A. Maksimova, V. N. Maksimov, and G. N. Kolesnitskaya.
Hydrobiological Journal, Vol 17, No 3, p 46-52, 1981. 4 Fig, 1 Tab, 8 Ref.

Descriptors: *Cellulose, *Pulp wastes, *Biodegradation, Fate of pollutants, *USSR, *Lake Baikal, Lakes, *Lake sediments, Cellulase activity, Sediments, Degradation, Bottom sediments, Deep water, Pulp and paper industry.

Biodegradation of cellulose from pulp mill effluents and from natural sources was studied in sediments from Lake Baikal. Cellulase activity was used as the indicator of ability of microorganisms to decompose vegetable cellulose. High, but variable, cellulase activity values were found in the zone of discharge from the pulp mill: 5.6-372.8 micrograms glucose per g dry sediment in winter and 16.0-378.0 micrograms glucose per g dry sediment in summer. Cellulose content in the sediment in 1976-78 was 20-45% of total organic matter. Numbers of cellulose degrading bacteria ranged from 900 to 12,000 per g dry sediment. In unpolluted zones away from the discharge, cellulase activity was fairly uniform, averaging 100 micrograms glucose per g dry sediment. Sediments from great depths, 1050-1100 meters, had cellulase activities of 99-134 micrograms glucose per g dry sediment. High lignin concentrations depressed cellulase activity in some regions of the lake. (Cassar-FRC)
W83-00600

THE FORMS IN WHICH MANGANESE MIGRATES IN THE WATER OF THE DNIEPER AND THE DESNA,
Akademiya Nauk URSR, Kiev. Inst. Hidrobiologii.
P. N. Linnik.
Hydrobiological Journal, Vol 17, No 2, p 95-96, 1981. 1 Tab.

Descriptors: *Manganese, *Chelation, *Seasonal variation, Fate of pollutants, Rivers, Dnieper River, Desna River, Phytoplankton, *USSR.

The seasonal dynamics of manganese in water of the Dnieper and Desna Rivers were studied using a chemical fluorescence procedure in conjunction with membrane filtration, electrodialysis, electromigration, and gel chromatography. In winter and spring, when organic matter levels and dissolved oxygen concentrations were minimum (1.2 mg per liter oxygen in the Dnieper and 0.4 mg per liter in the Desna) dissolved Mn was dominant (60% in Dnieper water and 80% in Desna water). Under oxidative conditions in spring dissolved Mn decreased sharply through precipitation as Mn02. Levels of Mn complexes were higher in the organic-rich Dnieper Water than in Desna water. Desna Mn complexes were mostly 1500-5000 molecular mass and less. Dnieper Mn complexes ranged in molecular mass from 500 to over 150,000. The concentration of Mn of the 500-5000 size was minimal during intensive growth of water plants. The concentration of low molecular mass compounds ($<$ 300) increased as the phytoplankton died off in late August and September. (Cassar-FRC)
W83-00601

ECOLOGICAL ASSESSMENT OF WATER QUALITY IN THE ESTUARINE REGION OF THE DANUBE,
Central Research Inst. on the Multi-purpose Use of Water Resources, Kiev (USSR).
A. I. Babarik, A. I. Sergiyenko, and A. P. Chernyavskaya.
Hydrobiological Journal, Vol 17, No 2, p 97, 1981.

Descriptors: Metals, *Estuarine environment, *Danube River estuary, Rivers, Water quality, Fate of pollutants, *Heavy metals, *USSR.

Water quality in the lower reaches of the Danube River on the USSR border is better than in the more industrialized upper reaches. However, at Reni (70 miles from the Black Sea) heavy metals concentrations are close to maximum permissible limits. Heavy metals gradually decrease downstream to a low of 10-30% of maximum permissible limits at Kilya (20 miles from the Black Sea). This reduction is caused by absorption by plant material, rocks, soil, sediment, and groundwater. Removal of suspended matter would decrease metals levels. (Cassar-FRC)
W83-00602

LARGE SUBSURFACE SEWAGE DISPOSAL SYSTEMS,
M. M. Ali, and H. T. Chan.
Research Publication No 89, Ministry of the Environment, Toronto, Canada, April 1982. 129 p, 64 Fig, 19 Tab, 38 Ref. 1 Append.

Descriptors: *Mathematical models, *Groundwater pollution, *Wastewater disposal, *Surface-groundwater relations, *Sewer systems, Subsurface drainage, Subsurface drains, Groundwater, Infiltration coefficient, Surface water, Water table, Leaching, Infiltration, Hydraulic gradient, Model studies, Mathematical equations.

A field investigation was conducted to determine the impact of a large (0.54 ha) subsurface sewage disposal system on groundwater. Groundwater mounding (GM) as influenced by soil conditions, hydraulic loading rate, climatic, and natural environmental factors could be predicted by either of two mathematical models. An estimate of the rise in water table (WT) due to the infiltration of surface water can be made on a statistical basis according to the weather data and at least 1-year of observational data on natural WT fluctuations. The degree of maximum rise should equal the sum of the rise caused by hydraulic loading and that due to surface infiltration. Comparing groundwater chemical levels before and after subsurface disposal, groundwater under and near the leaching bed approached levels of the feed. Maximum contaminant levels were within one meter below the WT. GM increased the contaminant velocity due to increased hydraulic gradient. Nitrate, chloride, sodium, calcium, sulfate, hardness, and conductivity were measured to assess the groundwater contamination. A modified Langmuir equation was used to determine the absorption capacity of the soil. (Zielinski-MAXIMA)
W83-00626

MONITORING TO DETECT GROUNDWATER PROBLEMS RESULTING FROM ENHANCED OIL RECOVERY,
Energy Resources Co., Inc., Cambridge, MA.
R. Beck, B. Aboba, D. Miller, and I. Kaklins.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-119074, Price codes: A07 in paper copy, A01 in microfiche. Environmental Protection Agency Project Summary EPA-600/S2-81-241, January 1982. 8 p, 4 Fig, 6 Tab. 68-03-2648.

Descriptors: *Monitoring, *Groundwater pollution, *Oil recovery, *Water pollution sources, Statistical analysis, Oil pollution, Oil industry, Mathematical models, Water pollution control, Oil spills.

All enhanced oil recovery (EOR) technologies involve potential groundwater concerns. Those technologies that require injection of chemicals into the reservoir or fracturing of formations hold the most potential for contamination. In situ combustion is also of particular concern because of the range of chemicals that are formed during the subsurface combustion process. A four-stage monitoring program was developed to detect groundwater contamination events that could result from EOR projects. The monitoring system design is based on a statistical analysis evolving from a series of equations that model subsurface transport of EOR spills. Results of the design include both spatial and frequency monitoring intervals that depend on properties of the local geology and dispersion characteristics of the potential contaminants. The four stages of monitoring are: develop baseline; monitor trend; specifically evaluate flagged problems; and assess effectiveness of controls. Selection of measures to be sampled is based on a review of the identity of likely contaminants, on the available sample and analysis procedures, and on the cost and time constraints on analysis. Comprehensive monitoring for each potential pollutant requires extensive budgetary commitments, while the measurement of indicator parameters rather than specific chemicals provides less detailed and precise information, but is a more certain way of obtaining useful returns for a given level of investment. The number of independent variables in the analysis dictate that EOR monitoring systems be designed on a site-specific basis. (Moore-SRC)
W83-00635

SORPTION OF ZINC BY LAKE MICHIGAN SEDIMENTS--IMPLICATIONS FOR ZINC WATER QUALITY CRITERIA STANDARDS,
Wisconsin Univ.-Stevens Point. Dept. of Chemistry.
G. E. Nienke, and G. F. Lee.
Water Research, Vol 16, No 9, p 1373-1378, September, 1982. 8 Tab, 12 Ref.

Descriptors: *Zinc, Sediments, *Sorption, Fate of pollutants, *Water quality standards, *Lake Michigan, *Lake sediments, Suspended sediments, Bottom sediments, Metals, Heavy metals.

The uptake and release of zinc from Lake Michigan sediments was investigated under aerobic and anaerobic conditions. Zn release was very pH dependent under aerobic conditions. Zn levels in water overlying a silty-clay sediment with moderate Zn content were 19-21 micrograms per liter at pH 6.0-6.1 and 9.0 micrograms per liter at pH 7.9; in a sandy-clay, low Zn sediment, 36 micrograms per liter at pH 6.0 and 3-11 micrograms per liter at higher pH. These sediments released Zn as pH was lowered. However, once the pH was lowered the sorption release mechanism was altered so that Zn release did not occur at pH $>$ 7.0. Under anaerobic conditions no appreciable Zn was released from the sediments during 2 weeks. If any Zn was released, it may have precipitated as the sulfide. Adding Zn to water in aerated systems showed the sediments' limited capacity to absorb more Zn, in this case 1.2-1.5 mg Zn per kg sediment. Treatment with 0.25 M HC1 released all Zn bound in the sediment. The likely form of Zn in the sediment was Zn(OH)2, ZnC03, or loosely bound by organic particulate matter. Since Zn is essentially irreversibly adsorbed onto aquatic sediments, the validity of the U.S. EPA water quality criterion on Zn is questioned. This criterion is based on total recoverable Zn concentrations. It is recommended that state water quality standards consider the concentrations of suspended matter in the water because discharges of Zn into relatively turbid water would have much less impact on aquatic organisms than discharges into clear waters. (Cassar-FRC)
W83-00643

DISTRIBUTION OF ENTEROVIRUSES IN SEDIMENTS CONTIGUOUS WITH A DEEP MARINE SEWAGE OUTFALL,
Miami Univ., Fl. Dept. of Microbiology.
G. E. Schaiberger, T. D. Edmond, and C. P. Gerba.
Water Research, Vol 16, No 9, p 1425-1428, September, 1982. 3 Tab, 22 Ref.

Descriptors: *Viruses, *Bacteria, *Outfalls, *Sediments, Coliforms, Beaches, Miami Beach, *Florida, Seawater, Marine sediments, Enteroviruses, Wastewater disposal.

The distribution of viruses and indicator bacteria from the Miami Beach, Florida, raw sewage outfall 3.6 km from shore and 44 m deep was studied. No bacteria or viruses were found in water samples collected further than 200 m from the outfall boil. Organisms survived at greater distances in sediments. Bacteria were isolated from sediment samples taken up to 400 m from the outfall boil. Viruses were detected in 2 of 5 sediment samples at concentrations of 15 and 30 PFU per liter at the bathing beach directly onshore from the outfall pipe, 3640 m from the outfall boil. Virus levels in sediments decreased with distance from the pipe outlet to the beach: 78-112 PFU per liter at the seaward end of the pipe at 3640 m from shore, 18-

23 PFU per liter at 3200 m from shore, and 0-2 PFU per liter at 100 m from shore. (Cassar-FRC)
W83-00645

THE USE OF URIC ACID AS A METHOD OF TRACING DOMESTIC SEWAGE DISCHARGES IN RIVERINE, ESTUARINE AND COASTAL WATER ENVIRONMENTS,
Plymouth Polytechnic (England).
For primary bibliographic entry see Field 5A.
W83-00646

INVESTIGATION ON THE MICROBIOLOGY OF THE SAAR RIVER (UNTERSUCHUNG ZUR MICROBIOLOGIE DER SAAR),
Universitaet des Saarlandes, Saarbruecken (Germany, F.R.). Dept. of Microbiology.
M. Schneider, U. Zaiss, and H. Kaltwasser.
Zeitschrift fur Wasser und Abwasser Forschung, Vol 14, No 2, p 31-37, 1981. 6 Fig, 2 Tab, 37 Ref. English Summary.

Descriptors: *Microbiological studies, Rivers, *Saar river, *Water pollution effects, Oxygen, Dissolved oxygen, Oxygen requirements, Water temperature, Effluents, Industrial wastewater, Path of pollutants, *France, *West Germany, Navigation canals, River flow, Denitrification, Nitrogen, Ammonium, Nitrate, Nitrite, Saprophytic bacteria, Tributaries, Rossel river, Artificial watercourses, Sulfur, Sulfates, Water quality.

Longitudinal profiles of the water quality of the Saar River (France and West Germany) are discussed. In 1975-6 the river was canalized for shipping from Sarregemines to Ensdorf and dammed as far as Mettlach. This was also the most heavily polluted zone. The slow flow in the dammed river led to a reduced oxygen input from the atmosphere, and this was accompanied by increased oxygen consumption in the water due to domestic and industrial effluents. The longitudinal profiles showed that the temperature of the river rose from the source to the mouth, with a maximum of 24C at Lisdorf (flow km 159) in the central, polluted section. Variations in temperature were not seasonal but depended mainly on inflow of cooling waters and heated effluents. Dissolved oxygen content declined from source to mouth, with particularly low levels in the canalized zone (e.g., 10.2% saturation below Sarrebourg). The concentration of saprophytic bacteria in August 1975 was 8400 cells/ml at the source, 2 million at flow km 152, in the order of 1 million at Lisdorf, and then declined downstream to 56,000 at Konz (km 240). Sulfate content was low (13.0-21.0 mg/l) at the source and extremely high in the canalized section (e.g., 183.9 mg/l at km 186); this was partially due to pollution from the coal mining industry and from intensive agriculture. Nitrogen compounds followed a similar trend, with ammonium reaching a maximum of 21.66 mg/l N below the mouth of the Rossel. The Rossel contributed greatly to the pollution of the Saar. Self-purification occurred downstream of the canalized zone. (Gish-FRC)
W83-00649

INTERLABORATORY TESTING OF THE LEACHABILITY OF WASTES AND SLUDGES (RINGVERSUCHE ZUR BESTIMMUNG DER ELUIERBARKEIT VON ABFALLEN UND SCHLAMMEN MIT WASSER),
F. Von Ammon, and F. Dietz.
Zeitschrift fur Wasser und Abwasser Forschung, Vol 14, No 2, p 51-60, 1981. 11 Fig, 9 Tab, 4 Ref. English Summary.

Descriptors: *Leaching, *Testing procedures, *Groundwater pollution, *Sludge disposal, Waste disposal, Laboratories, Surface water, Standards, Elution, Solubility, Waste dumps.

A working committee on sludge and sediments, part of the working group on water chemistry of the Society of German Chemists, developed a method to predict the endangerment of ground- and surface waters through the leaching of deposited wastes. Several interlaboratory experiments were performed to test the method and its reproducibility. The materials analyzed were ash from a municipal refuse incinerator, ash from a sludge treatment incinerator, and dilute sludge from the galvanizing industry with a relatively high heavy-metal content. Within the standard method, adjustments should be made according to the material to be tested; for example, plastic elution tubes should not be used for materials that could cling to the walls by sorption. Reducing the fragment size of the waste should be avoided as far as possible, and mixing during elution should be done sparingly. To achieve reproducible results, the proportion of dry waste to elution water should be held constant; in general, the ratio 100 g dry waste to 1 l elution fluid is used. For dilute sludge, the solid and liquid portions should be analyzed separately. Clean filtrate should be used for each elution step. The prediction of endangerment through leaching consists of the concentration of various substances in the waste; the interlaboratory experiments showed that concentrations can rise with multiple leaching, and this should be examined. Some substances leach over long periods; this is not so dangerous if large amounts leach at first with a rapid reduction thereafter. Multiple elution resolves the question of solubility of a substance; weakly soluble substances leach uniformly, highly soluble ones mainly on the first elution. At each step, the leachate is to be compared with the original mass of the material tested. While the method is successful in determining the leachability of substances with water in the laboratory, it cannot give quantitative information on the behavior and fate of wastes under the variable conditions of a refuse tip. (Gish-FRC)
W83-00650

HYDROGEOCHEMICAL PROSPECTING OF ORE-DEPOSITS, DEMONSTRATED ON SOME WATER ANALYSES FROM PERU. (HYDROGEOCHEMISCHE PROSPEKTION VON ERZLAGERSTATTEN DARGESTELLT ANHAND EINIGER WASSERANALYSEN AUS PERU),
Technische Univ., Munich (Germany, F.R.). Lehrstuhl fuer Hydrochemie und Hydrogeologie.
P. Udluft.
Zeitschrift fur Wasser und Abwasser Forschung, Vol 14, No 2, p 38-43, 1981. 3 Fig, 7 Tab, 4 Ref.

Descriptors: Rivers, *Water analysis, *Chemical properties, *Ore deposits, Lead, Zinc, Copper, Cadmium, *Heavy metals, Water sampling, Mineral prospecting, Drinking water, *Peru, Mineral water, Sulfates, Path of pollutants, Pollutant identification.

In order to investigate the usefulness of hydrogeochemical analyses for mineral prospecting, water samples were evaluated from the Rio Rimac, Peru, which in its headwaters flows through one of the most significant sulfidic deposits of zinc, copper, and lead in South America. Above the deposit, copper, zinc, and cadmium could not be detected in the river water, while lead was present in a concentration of 46.0 micrograms/l. The lead was thought to emanate from an ore smelting works 35 km to the east, being transported to the Rimac by easterly winds. A sample taken within the deposit area showed copper, zinc, cadmium, and lead at levels of 45.0, 428.0, 3.42, and 68.0 micrograms/l, respectively. Another sample taken about 100 km downstream and 3,700 m lower than the second revealed that the zinc content was reduced 20-fold in comparison with the second sample (21.0 micrograms/l), the copper content was reduced by half (20.0 micrograms/l), and cadmium was now undetectable, while the lead level remained the same. The high lead level indicates that lead is transported differently from other heavy metals. Sulfate concentration was 84.0 mg/l in the first sample, 170.0 mg/l in the second, and 16.0 in the third. When drinking water from the city of Lima was sampled, copper, zinc, and lead were found in concentrations of 25.0, 13.0, and 65.0 micrograms/l, respectively (cadmium was not detected). This water corresponds in content to that of the third sample. When these samples were compared with samples of water from ore-free areas of Peru, the usefulness of water analysis as an aid in prospecting was seen. (Gish-FRC)
W83-00674

SEWAGE PLUME IN A SAND AND GRAVEL AQUIFER, CAPE COD, MASSACHUSETTS,
Geological Survey, Boston, MA. Water Resources Div.
D. R. LeBlanc.
Available from the OFSS, USGS Box 25425, Fed. Ctr. Denver CO 80225, Price $5.00 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 82-274, 1982. 35 p, 18 Fig, 2 Tab, 34 Ref.

Descriptors: *Secondary wastewater treatment, *Land disposal, *Groundwater pollution, *Unconfirmed aquifers, Sand aquifers, Solute transport, Infiltration, Wastewater lagoons, Groundwater movement, Water quality, Chemical analysis, *Massachusetts, Cape Cod, Contaminant plume.

Secondarily treated domestic sewage has been disposed of to a sand and gravel aquifer by infiltration through sand beds at Otis Air Force Base, Massachusetts, since 1936. The disposal has formed a plume of contaminated ground water that is more than 11,000 feet long, is 2,500 to 3,500 feet wide and 75 feet thick, and is overlain by 20 to 50 feet of uncontaminated ground water derived from precipitation. The distributions of specific conductance, temperature, boron chloride, sodium, phosphorus, nitrogen, ammonia, nitrate, dissolved oxygen, and detergents are used to delineate the plume. The center of the plume contains up to 2.6 milligrams per liter detergents as MBAS (methylene blue active substances), 0.4 milligram per liter boron, 20 milligrams per liter ammonia-nitrogen, and specific conductance as high as 405 micromhos per centimeter. Corresponding levels in uncontaminated ground water are less than 0.1 milligram per liter detergents, less than 0.1 ammonia-nitrogen, less than 0.05 milligram per liter boron, and less than 80 micromhos per centimeter specific conductance. Chloride, sodium, and boron concentrations seem to be affected only by hydrodynamic dispersion. Phosphorus movement is greatly retarded by sorption. Detergent concentrations exceed 0.5 milligram per liter from 3,000 to 10,000 feet from the sand beds and reflect the use of nonbiodegradable detergents from 1946 through 1964. The center of the plume as far as 5,000 feet from the sand beds contains nitrogen as ammonia, no nitrate, and no dissolved oxygen. Ammonia is oxidized to nitrate gradually with distance from the center of the plume. (USGS)
W83-00688

5C. Effects Of Pollution

HEALTH EFFECTS ASSOCIATED WITH WASTEWATER TREATMENT AND DISPOSAL,
Cincinnati, Ohio, Health Effects Research Lab., Cincinnati, OH.
N. E. Kowal, and H. R. Pahren.
Journal of the Water Pollution Control Federation (Literature Review Issue), Vol 54, No 6, p 677-687, June, 1982. 110 Ref.

Descriptors: *Wastewater treatment, *Wastewater disposal, *Public health, *Reviews, Diseases, Incineration, Composting, Bacteria, Viruses, Pathogens, Parasites, Sludge, Aquaculture, Metals, Toxicity, Organic compounds, Fate of pollutants, Water pollution effects, Water reuse, Renovated water, Septic tanks, Industrial wastewater, Sewer systems, Land disposal.

Health effects associated with wastewater treatment, sludge incineration, sludge composting, land application of wastewater and sludge, wastewater aquaculture, septic tanks and other on-site systems, water reuse, and industrial wastewater were reviewed. Potential hazards of working and living near wastewater treatment plants were not severe. However, some bacteria were detected in downwind aerosols. Coliform populations exhibited an increased incidence of antibiotic resistance factor over several years. Incineration presented no serious health hazards. Composted sludge can be a source of exposure to Aspergillus, viruses, bacteria, and parasites if not properly processed. Land application of wastewater and sludge was the subject of many investigations. Some findings indicated little risk to human and animal health or to the environment when proper treatment and application techniques were followed. In contrast, other work

indicated adverse effects resulting from an accumulation of heavy metals in animal and plant tissues and the possible presence of Salmonella and other pathogens. Improper wastewater treatment and disposal lead to waterborne parasitic diseases, increases in mosquito populations in areas of wastewater spray irrigation, and bacterial infections. The survival of pathogens was studied with simulation models and by sampling wastewat er sludges and soils. Some investigations concluded that there was little risk of disease transfer in normal wastewater treatment and disposal. Others pointed out survival of parasitic cysts and ova, Salmonella and other bacteria, and viruses. Wastewater and effluents used in aquaculture should be carefully monitored before application, since aquatic plants and animals can concentrate pathogens and toxic elements. (Cassar-FRC)
W83-00371

EFFECTS OF 2,4-D ON NON-TARGET SPECIES IN KERR RESERVOIR,
Oral Roberts Univ., Tulsa, OK. Dept. of Natural Science.
For primary bibliographic entry see Field 3B.
W83-00378

ECOLOGICAL CONSEQUENCES OF LONG-TERM EXPOSURE OF ANABAENA VARIABILIS (CYANOPHYCEAE) TO SHIFTS IN ENVIRONMENTAL FACTORS,
Rensselaer Polytechnic Inst., Troy, NY. Dept. of Biology.
C. D. Collins, and C. W. Boylen.
Applied and Environmental Microbiology, Vol 44, No 1, p 141-148, July, 1982. 6 Fig, 2 Tab, 35 Ref.

Descriptors: *Algal blooms, *Light intensity, *Adaptation, Seasonal variation, Chlorophylla, Phytoplankton, *Anabaena variabilis, Photoadaptation, Photosynthesis, *Cyanphyta.

The time course for adaptation of the blue-green alga Anabaena variabilis to specific environmental conditions was measured to better understand the ecological consequences of environmental variability. The algal cultures were exposed to different light intensities, and the time course of photoadaptation was measured by photosynthetic rate and changes in pigmentation. The findings showed that successful adaptation was limited to a narrow range of temperature and light combinations, outside of which range adaptation was not attained. This not only provides a possible explanation for the decline of blooms, but may also provide an explanation of why blue-green algae do not normally develop bloom population densities. It is suggested that it may be possible to predict declines in algal blooms as a result of synoptic weather patterns of hydrodynamic influences. (Baker-FRC)
W83-00391

FACTORS AFFECTING THE TOXIC EFFECT OF TIN ON ESTUARINE MICROORGANISMS,
Cornell Univ., Ithaca, NY. Dept. of Agronomy.
L. E. Hallas, J. S. Thayer, and J. J. Cooney.
Applied and Environmental Microbiology, Vol 44, No 1, p 193-197, July, 1982. 1 Fig, 3 Tab, 30 Ref.

Descriptors: *Tin, *Estuarine environment, *Microorganisms, *Toxicity, *Heavy metals, Water pollution effects, Sediments, Gelatin, Silica gel, Cadmium, Copper, Lead, Nickel, Zinc, Serine, Humic acids, Sulfates, Nitrates, Chlorides, Speciation, *Maryland.

The influence of organic and inorganic ligands on the toxic effect of tin and other metals on estuarine microorganisms was investigated. The use of gelatin as a gelling agent decreased the apparent toxicity of tin, and toxicity was markedly reduced in medium solidified with silica gel. No evidence was obtained which suggested that toxic agar-tin complexes were involved. Cd, Cu, Pb, Ni, and Zn exhibited similar toxicity patterns. Therefore, toxicity levels determined in the laboratory should be extrapolated to the environment with caution. The addition of cysteine to the medium had no effect on tin toxicity. Serine or 3-hydroxyflavone enhanced toxicity, while humic acids or gelatin inhibited toxicity. Replacement of S04(2-1) with N03(-) did not change tin toxicity. However, the replacement of C1(-) with N03(-) decreased tin toxicity. Thus the toxic effect(s) of tin depend as much on the chemical speciation of the metal as on the total concentration of the metal in the medium. (Baker-FRC)
W83-00393

PHOSPHORUS REDUCTION IN A MAN-MADE LAKE BY MEANS OF A SMALL RESERVOIR ON THE INFLOW,
Hydrualic Research Inst., Prague (Czechoslovakia).
For primary bibliographic entry see Field 5G.
W83-00396

PHOSPHORUS EXPORT FROM COASTAL PLAIN DRAINAGE INTO THE PEEL-HARVEY ESTUARINE SYSTEM OF WESTERN AUSTRALIA,
Western Australia Dept. of Conservation and Environment, Perth.
For primary bibliographic entry see Field 5B.
W83-00408

INTERTIDAL COMMUNITY OFFSHORE FROM THE WERRIBEE SEWAGE-TREATMENT FARM: AN OPPORTUNISTIC INFAUNAL ASSEMBLAGE,
Interstate Electronics Corp., Anaheim, CA. Ocean Sciences Dept.
J. H. Dorsey.
Australian Journal of Marine and Freshwater Research, Vol 33, No 1, p 45-54, 1982. 1 Fig, 6 Tab, 29 Ref.

Descriptors: *Wastewater pollution, *Organic matter, *Invertebrates, Water pollution effects, Port Phillip Bay, Werribee, *Australia, Nutrients, Intertidal areas, Species diversity, Benthic fauna, Sediments.

A survey was conducted of the macrofauna and its sediment habitat in areas of intense predation by wading birds in the intertidal area of the Port Phillip Bay ecosystem, Victoria, Australia. Species diversity was low and abundance very high in the upper intertidal sediments between 2 municipal effluent drains emptying into the bay. Sampling done in late spring 1979 showed opportunistic species such as polychaetous annelids, corophiid amphipods, and bivalve mollusks. Deposit feeders comprised 38.7% of total individuals; deposit-suspension feeders, 27.7%; suspension feeders, 33.4%; and omnivores, carnivores, and unknown, each 0.1%. Number of species found at each station was 14 to 22. Densities of individuals at the drains were over 300,000 per sq m; between the 2 drains, 100,000-300,000 per sp m. Juveniles contributed significantly to the macrofaunal abundance. The sediments consisted of 2.7% organic matter, 30.7% shell debris, 6.3% mud, and the remainder fine to medium sand. (Cassar-FRC)
W83-00409

PHOSPHORUS AND NITROGEN LOADS IN WATERS ASSOCIATED WITH RIVER MURRAY NEAR ALBURY-WODONGA, AND THEIR EFFECTS ON PHYTOPLANKTON POPULATIONS,
Adelaide Univ. (Australia). Dept. of Zoology.
K. F. Walker, and T. J. Hillman.
Australian Journal of Marine and Freshwater Research, Vol 33, No 2, p 223-243, 1982. 9 Fig, 8 Tab, 20 Ref.

Descriptors: *Nutrients, *Phytoplankton, *Streamflow, Eutrophication, Lakes, Water pollution effects, Turbidity, Murray River, *Australia, *Phosphorus, *Nitrogen, Nitrates, Light penetration, Algal growth.

Phosphorus and nitrogen loads were measured during 1974-77 in the Murray River system, Australia, including some of its tributaries and two impoundments. The purpose was to document nutrient loads at different river flows and assess the trophic status of the impoundments. Nutrient loads varied directly with streamflow. Mean total P loads (in kg per day) measured at several stations were 138-1473 in the wet years 1974-75 and 42-496 in the dry years 1976-77. Mean total TKN loads (in kg per day) were 1121-19,983 in 1974-75 and 723-333 in 1976-77. Nitrate loads (kg N per day) were 148-2487 in 1974-75 and 39-652 in 1976-77. Phytoplankton biomass (average below 2000 cu mm per cu m) did not correspond to the variations in nutrient concentrations. Growth was probably restricted by low light penetration caused by high turbidities during high flow periods. Results indicated that continued growth in the urban population at Albury-Wodonga on the Murray would contribute to nuisance algal blooms during low flow periods. (Cassar-FRC)
W83-00410

BIOACCUMULATION OF ORGANOCHLORINES BY YEARLING COHO SALMON (ONCORHYNCHUS KISUTCH WALBAUM) FED DIETS CONTAINING GREAT LAKES' COHO SALMON, AND THE PATHOPHYSIOLOGICAL RESPONSES OF THE RECIPIENTS,
Guelph Univ. (Ontario). Dept. of Zoology.
J. F. Leatherland, and R. A. Sonstegard.
Comparative Biochemistry and Physiology C: Comparative Pharmacology, Vol 72C, No 1, p 91-99, 1982. 6 Tab, 28 Ref.

Descriptors: Fish, *Bioaccumulation, *Pesticides, Fate of pollutants, Water pollution effects, Accumulation, *Salmon, *Great Lakes, Lakes, Polychlorinated biphenyls, DDE, DDT, *Organochlorine pesticides, Chlordane, Mirex, Lindane, Lake Ontario, Lake Erie, Lake Michigan.

Yearling coho salmon were fed for 47 weeks on diets containing flesh from sexually mature adult coho salmon from Lakes Ontario, Erie, and Michigan. Chopped coho salmon from the Pacific Ocean and a commercial trout chow served as control diets. The total organochlorine burdens (in micrograms per kg) in the diets were Lake Michigan salmon, 8277; Lake Ontario, 7509; Lake Erie, 2630; Pacific Ocean, 199; and trout chow, 187. Polychlorinated biphenyls ranged from 70.1 to 82.9% of the total organochlorines in the fish diets. Also present were DDE (10.5-19.9%), chlordane (5.1-2.4%), DDD (6.3-2.5%), mirex, BHC, and lindane. The total accumulation of organochlorines in the young salmon was directly proportional to the total organochlorine levels in their diets. Total accumulated organochlorine levels (micrograms per g) in fish fed the various diets were: Ontario, 6.6; Erie, 2.2; Michigan, 8.8; Pacific Ocean, 0.3; and trout chow, 0.2. Ratios of organochlorine consumed to organochlorine accumulated in fish tissue were 0.18 for the Great Lakes fish diet, 0.29 for the Pacific Ocean diet, and 0.39 for the trout chow. Compared with controls, fish fed the Great Lakes salmon flesh showed significant differences in thyroid physiology, hematocrit, liver structure, and interrenal gland activity. (Cassar-FRC)
W83-00418

EUTROPHICATION,
Colorado Univ., Boulder.
A. J. Medine, and D. B. Porcella.
Journal of the Water Pollution Control Federation, (Literature Review Issue) Vol 54, No 6, p 770-778, June, 1982. 116 Ref.

Descriptors: *Eutrophication, *Lakes, *Literature review, *Model studies, Bioindicators, Eutrophic lakes, Nutrients, Phosphorus, Phytoplankton, Chlorophyll, Ecosystems, Computer models, Biomass, Laboratories, Algae, Lake restoration, Destratification, Phosphorus removal, Water pollution.

This literature review of 116 publications on eutrophication covers six major aspects of the subject. Two symposia are briefly mentioned: one of 95 papers on nutrient loading relationships, and one of 15 papers on reservoir phytoplankton dynamics. Nutrient loading models based on Vollenweiders approach are still used in management analysis and decision making, and the approach was used for a prediction of total phosphorus developed from data from 704 lakes; statistical phosphorus-reten-

tion models were the subject of another work. Eutrophication indicators were studied in several papers. Specific topics included phytoplankton biomass and its correlation with chlorophyll a and hypolimnetic oxygen consumption in lakes. Complex models of eutrophication and ecosystems with many variables were often used to improve prediction and reduce variance. Validation and uncertainty and parameter estimation in models were important issues in the works reviewed. Nutrient sources and sinks were the subject of studies including storm runoff in urban, wetland, and agricultural areas as well as wastewater effluents. Phosphorus sediment release and cycling and nitrogen fixation were also covered by the works reviewed. Twenty publications covered the topic of biological and chemical interactions. The organisms studied included phytoplankton, zooplankton, diatoms, benthic algae, and water chestnuts. Bioassay and laboratory studies included investigations of algal-available phosphorus and biologically available phosphorus in lakes, of the growth-limiting effect of light on epilimnetic phytoplankton, and of the effect of phosphorus on algal growth. The last category of papers covered the subject of lake management, including analysis methods, lake restoration techniques, phosphorus removal and artificial destratification. (Gish-FRC)
W83-00477

EMERGENCY RESPONSE: A CASE FOR RISK DETERMINATION,
Maine Dept. of Human Service, Augusta.
For primary bibliographic entry see Field 5F.
W83-00494

THE EUTROPHICATION OF CAYUGA LAKE: A HISTORICAL ANALYSIS OF THE PHYTOPLANKTON'S RESPONSE TO PHOSPHATE DETERGENTS,
Massachusetts Univ., Amherst. Water Resources Research Center.
P. J. Godfrey.
Freshwater Biology, Vol 12, No 2, p 149-166, April, 1982. 11 Fig, 4 Tab, 46 Ref. OWRT B-038-NY.

Descriptors: *Lakes, *Eutrophication, *Cayuga Lake, Detergents, Nutrients, Phosphates, Phosphorus, Phytoplankton, Algal growth, Algae, Seasonal variations, Water pollution effects, *New York.

A methodology is presented for comparing past with present data to demonstrate that there has been a significant increase in algal standing crop and a dramatic change in their seasonal succession pattern, and to postulate the causal mechanism for these observations based on the pattern of hydrological inputs of phosphorus and its lake dynamics and the timing of significant changes in the long term pattern of phosphorus loading to Cayuga Lake. Samples were collected weekly between April 1972 and August 1973. The seasonal pattern of total phytoplankton biomass exhibited a maximum in late spring just prior to stratification, a sharp decline to intermediate values that persisted through summer and autumn, a mild resergence at the autumn overturn and yearly minimum from winter through early spring. Coincident with initial summer stratificat ion in July 1972 and 1973, there was a bloom of Anabaena flos-aquae (Lyngb.) DeBrebisson. The combination of data on algal biomass, chlorophyll and Secchi disc transparency serves to describe the long term trend in the lake's trophic state and demonstrate a large increase in algal standing crop in the period roughly coincidental with the advent of phosphorus-based detergents. The increase in algal standing crop from pre-1940 levels to present levels closely corresponds with that predicted by the Oglesby-Schaffner regression model from the increase in phosphorus loading due to phosphorus-based detergents. (Baker-FRC)
W83-00509

THE RESORPTION OF ZINC FROM SCALES OF SEA TROUT (SALMO TRUTTA) DURING THE UPSTREAM SPAWNING MIGRATION,
Liverpool Univ. (England). Dept. of Zoology.
For primary bibliographic entry see Field 5B.
W83-00511

NUTRIENT DEPENDENCE OF PHYTOPLANKTON PRODUCTION IN BROWN-WATER LAKES WITH SPECIAL REFERENCE TO LAKE PAIJANNE,
Hydrobiolofical Research Inst., Jyvaskyla Univ. (Finland).
K. Granberg, and H. Harjula.
Hydrobiologia, Vol 86, No 1/2, p 129-132, January, 1982. 1 Fig, 1 Tab, 16 Ref.

Descriptors: *Nutrients, *Phytoplankton, *Productivity, *Phosphorus, Limiting nutrients, Brown-water, Lakes, Lake Paijanne, *Finland, *Chlorophyll a, Humic acids, Model studies, Water pollution effects.

A model was developed to predict the mean seasonal chlorophyll a concentration, the mean seasonal in vitro phytoplankton primary productivity per unit volume, the maximum daily production per unit volume, and the seasonal integral production in brown-water lakes limited by phosphorus. The values necessary for calculation are mean annual concentration of total P and mean annual color of the water. Data collected at 4 sampling sites of Lake Paijanne, Finland, and in 1972-79 were used to verify the equations. Calculated and predicted results were in reasonable agreement. Differences were mainly due to hydrological and climatic conditions that could not be included. However, the model is adequate for cheap and rapid predictions of the major biological consequences of changes in effluent loads. (Cassar-FRC)
W83-00524

AN OXYGEN MODEL FOR LAKE HAUKIVESI,
National Board of Waters, Helsinki (Finland).
T. Frisk.
Hydrobiologia, Vol 86, No 1/2, p 133-139, January, 1982. 2 Fig, 12 Ref.

Descriptors: *Lakes, *Water quality, *Dissolved oxygen, Hypolimnion, Model studies, Lake Haukivesi, *Finland, Pulp and paper industry, Oxygen, Decomposition, Water pollution effects, Biological oxygen demand, Phosphorus, Phytoplankton, Oxygen demand, Organic matter.

A water quality model to predict dissolved oxygen in the hypolimnion of Lake Haukivesi, Finland, heavily loaded with pulp and paper mill effluents, was developed. The lake was divided into 7 sub-basins of 2 layers each, epilimnion and hypolimnion. Transfer between sub-basins was calculated using water balance equations. A hydrological steady state was assumed. State variables were dissolved oxygen, BOD, total P, and phytoplankton biomass; temperature was an external variable. Processes affecting the concentration of dissolved oxygen were BOD decay, reaeration, growth and respiration of phytoplankton, benthic oxygen demand, and oxygen consumption of slowly decaying substances. Preliminary testing of the model indicated that the basic structure was adequate for practical predictions of water quality. However, further development and testing is proceeding, with special attention to mass balance of organic matter and P in sediments. (Cassar-FRC)
W83-00525

WINTER MICROBIAL ACTIVITY IN LAKE TUUSULANJARVI,
Helsinki Water District (Finland).
For primary bibliographic entry see Field 5G.
W83-00528

THE EFFECT OF LAND USE ON THE DIATOM COMMUNITIES IN LAKES,
Joensuu Univ. (Finland). Karelian Inst.
J. Merilainen, P. Huttunen, and K. Pirttiala.
Hydrobiologia, Vol 86, No 1/2, p 99-103, January, 1982. 3 Fig, 11 Ref.

Descriptors: *Diatoms, *Land use, *Species composition, Lakes, Sediments, *Finland, Agricultural watersheds, Peat, Water quality, Chlorides, Oligotrophic lakes, Hydrogen ion concentration, Phosphorus.

The relationship of diatom community structure to land use was investigated using data from 151 oligotrophic lakes in eastern Finland. Lakes ranged from 5 to 1500 ha and did not included those with short residence time or shallow unstratified lakes. Lakes in catchments with little or no arable fields had pH of 4.5-7.5. Lakes in agricultural watersheds had pH of 6.5 or greater. Field percentage was positively correlated with conductivity, Na, K, Ca, and Mg concentrations of lake water and highly significantly correlated with Cl. An increasing percentage of peatland was correlated with a decrease in pH. Lakes surrounded by fields rarely contained Melosira distans (s.s.), Frustulia rhomboides (including F. R. var. saxonica), and Eunotia spp. (excluding E. arcus), common diatoms in oligotrophic lakes. However, Fragilaria construens (s.l.) was well represented in lakes in agricultural areas. Increasing pH decreased the proportion of Frustulia rhomboides and Eunotia spp. Fragilaria construens and Melosira ambigua were more frequent in waters with higher pH. Increasing conductivity of water was correlated with decreases in proportions of Frustulia rhomboides, Eunotia spp., and Melosira distans, whereas Fragilaria construens and Melosira ambigua increased. Frustulia rhomboides, Eunotia spp., and Melosira distans decreased with increasing total phosphorus levels. (Cassar-FRC)
W83-00530

THE INFLUENCE OF SULPHITE MILL EFFLUENTS ON HETEROTROPHIC ACTIVITY AS MEASURED BY GLUCOSE ASSIMILATION,
Tvarminne Zoological Station (Finland).
J. Kuparinen.
Hydrobiologia, Vol 86, No 1/2, p 115-119, January, 1982. 4 Fig, 11 Ref.

Descriptors: *Heterotrophic bacteria, *Sulfite liquors, *Phytoplankton, *Adaptation, Water pollution effects, Pulp wastes, Primary productivity, Productivity, *Finland.

The effect of sulfite mill effluents on the heterotrophic activity of natural populations in Finland receiving waters was studied during the summer of 1979. Effluent was added at concentrations of 0.001-10% to water samples from different sections of rivers receiving effluent. Organisms near the discharge point were adapted to high concentrations of the effluent (up to 10%). At other stations 50% inhibition was seen as low as 0.01%. Low concentrations of effluent, 0.001-0.1%, stimulated heterotrophic activity at some stations. Primary productivity was 10-100 mg C per cu m per day, lowest at the sites highest in effluent concentrations. Turnover times were 5-20 hours. (Cassar-FRC)
W83-00536

SPECIES ASSOCIATIONS AND METAL CONTENTS OF ALGAE FROM RIVERS POLLUTED BY HEAVY METALS,
Cambridge Univ. (England). Dept. of Applied Biology.
P. L. Foster.
Freshwater Biology, Vol 12, No 1, p 17-39, February, 1982. 8 Fig, 5 Tab, 61 Ref.

Descriptors: *Algal growth, *Trace metals, Metals, Lead, Zinc, Rivers, Water pollution effects, Iron, Copper, Mining wastes, River Hayle, River Gannel, *England, Industrial wastes, Drainage.

The algal flora of several siteson the Rivers Hayle and Gannel were examined and an evaluation was made on the impact of heavy metal pollution on the abundance, diversity, and species composition of the algal communities. The metal composition of the dominant filamentous algae is also presented and related to ambient concentrations. The River Hayle is located in a former copper and tin mining area. The River Gannel drains the Cornish lead mining region of Newlyn Downs. Both the total algal abundance and the number of species were depressed at sites of high metal concentrations. Associations of species that were evident in field samples were confirmed and correlated with water

metal levels by principal component analysis. The degree of metal pollution, rather than the polluting metal per se, determined the species present. All mine sites were characterized by a Microspora community, whereas a Zygnemales community of Spirogyra and Mougeotia species was typical of low metal pollution. Moderately polluted sites downstream of the mines had an intermediate flora of Zygnemales, Microsporales, Ulotrichales and gelatinous Volvocales and Tetrasporales species. No species could be used to invariably indicate metal pollution. For copper and iron both algal metal contents and concentration ratios were positive functions of water metal levels, although algal iron appeared to plateau at water concentrations of about 1 mg/ml. Algal lead concentrations, but not concentration ratios, were also positively correlated with water lead levels. (Baker-FRC)
W83-00537

METAL RESISTANCES OF CHLOROPHYTA FROM RIVERS POLLUTED BY HEAVY METALS,
Cambridge Univ. (England). Dept. of Applied Biology.
P. L. Foster.
Freshwater Biology, Vol 12, No 1, p 41-61, February, 1982. 2 Fig, 6 Tab, 38 Ref.

Descriptors: *Rivers, *Heavy metals, *Algae, Population dynamics, Zinc, Cadmium, Metals, Water pollution effects, Chlamydomonas, Gloeococcus, *Chlorophyta, *England.

The metal sensitivities of a large number of isolates from two Cornish rivers were experimentally determined, and the distributions of metal resistance within these algal associations were evaluated. The two rivers were polluted, one with lead and the other with copper. By comparing significant portions of the algal communites from variously contaminated sites, the degree to which the metals were selecting tolerant races or naturally resistant species could be assessed. Two hundred isolates comprising 87 species of Chlorophyta were obtained. In general, all were resistant to the metals normally present in their own habitats. However, the distribution of metal sensitivities of the algae from a given site was broad. The effect of metal pollution was to shift the median response of a population toward higher metal resistance. Resistant algae of two general classes were identified. Some normally sensitive species were metal tolerant, presumably through genetic adaptation. Other species were metal resistant even when isolated from a non-polluted habitat. Many isolates of both types displayed multiple resistances or co-tolerances. For example, copper tolerant isolates from high copper sites tended to be also lead resistant. However, algae from high lead sites were very copper sensitive. Zinc and cadmium resistances also were correlated among isolates from both zinc-polluted and non-polluted sites. General metal-insensitivity seemed to be common, particularly among gelatinous Chlamydomonas and Gloeococcus species. Thus several evolutionary strategies appear to coexist among algae from metal polluted environments. (Baker-FRC)
W83-00538

SOME EFFECTS OF ORGANIC POLLUTION ON THE DISTRIBUTION AND SEASONAL INCIDENCE OF CHIRONOMIDAE IN RIFFLES IN THE RIVER COLE,
Aston Univ., Birmingham (England). Dept. of Biological Sciences.
L. J. Davies, and H. A. Hawkes.
Freshwater Biology, Vol 11, No 6, p 549-559, December, 1981. 5 Fig, 3 Tab, 25 Ref.

Descriptors: *Water pollution effects, *Midges, Wastewater disposal, Seasonal variations, Rivers, River Cole, Organic compounds, *England.

The distribution and seasonal abundance of chironomid larvae in a stream receiving sewage effluent was investigated. Sampling was carried out on the River Cole, a tributary of the River Blythe. The stream arises to the southwest of Birmingham and flows northwards through a rural and then residential area before entering a highly industrialized zone of the city. An intensive monthly sampling program was undertaken between December 1966 and December 1967. The river water can be described as moderately hard and slightly alkaline. Usually the calcium concentration and pH increased downstream, although the differences between the stations were not great. The sewage effluent reduced the dissolved oxygen concentration and increased the ammonia, orthophosphate and biochemical oxygen demand concentrations in the water. The effects were much more severe during the summer. The Chironomidae were very important constituents of the benthic macroinvertebrate community at the stations downstream of the effluent. Larval densities of over 30,000/square meter were noted. Eleven species were common, and of these, Chironomus riparius was the most tolerant. There was considerable variation in the seasonal incidence of the different species. Brillia longifurca was the most abundant in spring, while Cricotopus bicinctus was most abundant in the summer. Brillia longifurca, Paratrichocladius rufiventris, Prodiamesa olivacea, Micropsectra atrofasciata and Eukiefferiella claripennis had three peaks in numbers of larvae during the year. (Baker-FRC)
W83-00539

EFFECTS OF CHLORINATED SEWAGE EFFLUENTS ON FISH IN THE SHEEP RIVER, ALBERTA,
Calgary Univ. (Alberta). Dept. of Biology.
L. L. Osborne, D. R. Iredale, F. J. Wrona, and R. W. Davies.
Transactions of the American Fisheries Society, Vol 110, No 4, p 536-540, July, 1981. 2 Tab, 28 Ref.

Descriptors: *Water pollution effects, *Fish populations, *Chlorination, Fish, Wastewater disposal, Wastewater treatment, Dissolved oxygen, Biochemical oxygen demand, Toxicity, *Alberta.

The effects of chlorinated municipal wastes on fish in the Sheep River, Alberta, Canada were investigated. The 24-hour acute toxicity of unchlorinated and chlorinated municipal wastes to caged rainbow trout in the field, the avoidance by fish of chlorinated sewage effluents in the field, and the effects on fish of restricting the chlorinated effluent to only one side of the river were studied. The absence of mortality to fish during the unchlorinated bioassay demonstrated that the Turner Valley municipal sewage effluent was not acutely toxic to caged rainbow trout during a 24 hour exposure. The depletion of fish populations downstream of chlorinated domestic discharges has been attributed to a reduction in dissolved oxygen rather than to effluent toxicity. However, the dissolved oxygen concentration in the study area was consistently high, and the cause of mortality in stations further downstream was related to chlorination of the effluent as the principal factor. While fish did usually avoid the chlorinated effluents, they moved into and out of the chlorinated effluent, presumably to forage. (Baker-FRC)
W83-00582

SURVIVAL AND GROWTH OF PHYTOPHAGOUS FISH AS A FUNCTION OF OXYGEN CONCENTRATION IN WATER,
Akademiya Nauk URSR, Kiev. Inst. Hidrobiologii.
V. R. Alekseyenko.
Hydrobiological Journal, Vol 17, No 3, p 107-108, 1981.

Descriptors: *Fish, *Oxygen depletion, *Growth rates, Water pollution effects, *Dissolved oxygen, Adaptation, Larvae, Fish eggs, Grass carp, White bighead, Oxygen, USSR.

The growth and survival of phytophagous fish larvae were studied at varying concentrations of dissolved oxygen. In the first series of experiments grass carp and white bighead larvae, 3-4 days old, hatched from high quality eggs were subjected to dissolved oxygen concentrations of 1 to 10 mg per liter at 30C for 12-15 days. No significant correlation was found between larval survival and oxygen concentration. However, the growth rate of grass carp larvae was 12-16% lower at 1.7-2.3 mg per liter dissolved oxygen (final length 17.7-18.4 mm) than at 3.7-8.3 mg per liter (final length 20-22 mm). The second series of experiments used larvae from eggs of low viability. Survival of these larvae was significantly lower at lower oxygen concentrations. Grass carp larval survival was 46-51% in water with high oxygen content and 20-24% in water with low oxygen content. White bighead larvae survival was 39-54% in water with high oxygen content and 25-30% in water with low oxygen content. (Cassar-FRC)
W83-00594

THE STRUCTURE AND ABUNDANCE OF RYBINSK RESERVOIR ZOOPLANKTON AS A FUNCTION OF THE CONCENTRATION OF ZINC AND CHROMIUM COMPOUNDS,
Moscow Univ. (USSR).
N. V. Kartasheva, and L. I. Lebedeva.
Hydrobiological Journal, Vol 17, No 2, p 60-65, 1981. 3 Tab, 14 Ref.

Descriptors: Metals, *Toxicity, *Zooplankton, Water pollution effects, Heavy metals, Reservoirs, *Zinc, *Chromium, Rybinsk Reservoir, Rotatoria, Copepods, Invertebrates, Species composition, Sublethal effects, Laboratory studies, *USSR.

Natural zooplankton communities from Rybinsk Reservoir were subjected to 9 combinations of Zn and Cr dissolved in water in laboratory tanks. Metals levels (in mg per liter) were: 0.115 of Zn and 0.002 of Cr, the natural levels in water; 1 of Zn and 0.1 of Cr, the maximum permissible concentrations; and 2 of Zn and 1 of Cr, multiples of the maximum permissible concentrations. Community changes were observed during 3 periods during which: (1) the control population did not differ from the natural reservoir population, about 7 days long; (2) the population in the control and dosed tanks changed with respect to the natural reservoir populations; and (3) a specific community structure was established as a response to the toxic substances providing that the entire community was not destroyed. Zn was more toxic than Cr. Rotatoria abundance was reduced 8-12 times by 1 mg per liter Zn and 3-4 times by 1 mg per liter Cr. As Rotatoria declined, Copepoda increased in abundance. The effect of the 2 metals was additive. At the maximum concentrations of both metals in combination, the zooplankton population had completely degraded within a month. Rotatoria were more sensitive to both metals than other zooplankton. Brachionus angularis and Filinia longiseta were more sensitive to Zn; Polyarthra euryptera and P. luminosa, to Cr. (Cassar-FRC)
W83-00596

THE FEEDING OF KANEV RESERVOIR FISHES IN CONNECTION WITH THE DISCHARGE OF HEATED WATER FROM THE TRIPOL'YE POWER STATION,
Akademiya Nauk URSR, Kiev. Inst. Hidrobiologii.
N. S. Severenchuk.
Hydrobiological Journal, Vol 17, No 2, p 15-17, 1981. 6 Ref.

Descriptors: Fish, *Thermal pollution, *Food habits, Water pollution effects, Heated water, Tripol'ye Power Station, Kanev Reservoir, *USSR, Powerplants, Fish food organisms, Seasonal variation.

The effect of the heated water discharges from the Tripol'ye Power Station on the nutrition of mature fishes in Kanev Reservoir was investigated in 1974-77. Conditions for feeding of bream and blue bream were slightly more favorable in the heated zone than in the unheated zone. For the other fish (white bream, roach, and ide) there was little difference in feeding in the different zones. Main food items for fish in this reservoir were mollusks, gammarids, oligochaetes, and larvae of aquatic insects. Supplementary foods included water plants, algae, and detritus. Blue bream also consumed crustaceans. In spring fish were hungry and consumed all the available food items regardless of type. In summer, with abundant food, a few preferred items were selected. During autumn feeding activity declined, and diversity of food consumed increased

slightly. In winter fish fed appreciably less but still showed preference for some food items. (Cassar-FRC)
W83-00598

FUNDAMENTAL PRINCIPLES OF THE COMPARATIVE TOXICOLOGICAL EXPERIMENT,
Institute of Ecological Toxicology, Baikal (USSR).
V. A. Alekseyev.
Hydrobiological Journal, Vol 17, No 3, p 73-80, 1981. 1 Fig, 2 Tab, 4 Ref.

Descriptors: *Toxicity, Aquatic life, *Indicators, Invertebrates, *Bioindicators, Water pollution effects, Survival, Mortality, *Lethal limit.

A unified system of indicator organisms for testing toxicity of water pollutants is suggested. This procedure is based on the comparative tolerance of aquatic organisms of different taxonmic rank to various toxic substances. A list of taxa suitable for use in the studies is given. It includes crustcea, insects, arachnids, flat and round worms, annelids, leeches, and mollusks. Procedures are described for collecting the faunal specimens, for exposing them to the toxicants, and for recording results. The experiments produce the following indicators: maximum tolerated concentrations (LD100 and LD50) and maximum concentration at which no organism dies (LD0). The animals present in the sample are ranked according to tolerance in terms of the above 3 indicators. (Cassar-FRC)
W83-00603

SEASONAL SUCCESSION OF PHYTOPLANKTON IN AN ICE-FREE POND WARMED BY A THERMAL POWER PLANT,
Jyvaskyla Univ. (Finland). Dept. of Biology.
P. Eloranta.
Hydrobiologia, Vol 86, No 1/2, p 87-91, January, 1982. 2 Fig, 7 Ref.

Descriptors: *Thermal pollution, *Phytoplankton, *Cooling water, Water pollution effects, Zooplankton, Seasonal variation, Periphyton, Heated water, Powerplants, Diatoms, Succession, Nutrients, Water temperature, Primary productivity, Productivity, Ponds, Light penetration, Light intensity.

Water quality, phytoplankton, zooplankton, and periphyton were monitored from January 1979 to September 1980 in a nearly ice free pond which receives thermal discharges from a power plant. The pond is stratified in summer. In winter temperature is nearly even from surface to bottom, and circulation occurs in the 0-4 m layer. No sewage enters this moderately eutrophic pond. Primary production was low (2 mg C assimilated per sq m per day) and phytoplankton biomass was almost zero in January-February during low light conditions. Rapid growth of phytoplankton (cryptomonads and diatoms) started in mid-February as light intensity, nutrient conditions, and herbivorous zooplankton also increased. In mid-March phytoplankton biomass reached a peak of 10 g per cu m and rapidly declined due to lack of free phosphorus and silica. From May to August phytoplankton biomass and primary production fluctuated as a result of zooplankton ingestion. Productivity declined from August to winter, but phytoplankton (large-celled Cyclotella meneghiniana) reached a peak of 10 g per cu m in September. At this time zooplankton concentrations were low and nutrient concentrations had increased. Periphyton growth reached peaks of about 0.7 micrograms chlorophyll a per sq cm per 2 weeks in March and September. (Cassar-FRC)
W83-00605

COMMUNITY HEALTH ASSOCIATED WITH ARSENIC IN DRINKING WATER IN MILLARD COUNTY, UTAH,
Utah Dept. of Health, Salt Lake City.
J. W. Southwick, A. E. Western, M. M. Beck, J. Whitley, and R. Isaacs.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-108374, Price codes: A04 in paper copy, A01 in microfiche. Environmental Protection Agency Project Summary EPA-600/S1-81-604, February 1982, 3 p, 2 Tab.

Descriptors: *Arsenic, *Drinking water, *Toxicity, *Carcinogens, *Water pollution effects, Human pathology, Population exposure, Water quality standards.

This study evaluates the human health effects of ingesting drinking waters with arsenic at levels about four times the United States Environmental Protection Agency primary drinking water standard. Examinations of 250 cases included dermatological, neurological, and anemia endpoints. Hair and urine were tested for arsenic content. Estimates of water consumption provided the exposure criteria. One hundred and forty-five 'exposed' cases drank water with arsenic at 0.18 - 0.21 mg/liter. One hundred and five matched controls were selected from a neighboring community with arsenic at 0.02 mg/liter in their drinking waters. Cases were of either sex, over five years old, and residents of the community for the last five years. Controls were selected by random number selection from within age categories to match age and sex distribution of the exposed population. No exposure of controls to arsenic by use of arsenic-containing chemicals was found. A clear relationship is shown between amount of arsenic consumed and levels in urine and hair. Dermatological signs associated with arsenic exposure were rare and scattered among exposed and control participants. Anemia, nerve conduction slowing, and signs/symptoms of arsenic intoxication were not found in the study population. Cancer incidence or mortality did not show an excess in the exposed community. No adverse human health effects were discovered among this relatively small population exposed to drinking water with arsenic at four times the primary drinking water standard. (Author's abstract)
W83-00630

INVESTIGATION ON THE MICROBIOLOGY OF THE SAAR RIVER (UNTERSUCHUNG ZUR MICROBIOLOGIE DER SAAR),
Universitaet des Saarlandes, Saarbruecken (Germany, F.R.). Dept. of Microbiology.
For primary bibliographic entry see Field 5B.
W83-00649

MICROBIOLOGY: DETECTION OF BACTERIAL PATHOGENS AND THEIR OCCURRENCE,
Environmental Protection Agency, Cincinnati, OH. Drinking Water Research Div.
For primary bibliographic entry see Field 5A.
W83-00658

LAKE ERIE CLADOPHORA IN PERSPECTIVE,
Ecology and Environment, Inc., Buffalo, NY.
For primary bibliographic entry see Field 2H.
W83-00661

ECOLOGICAL STUDIES AND MATHEMATICAL MODELING OF CLADOPHORA IN LAKE HURON: 3. THE DEPENDENCE OF GROWTH RATES ON INTERNAL PHOSPHORUS POOL SIZE,
Michigan Technological Univ., Houghton. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2H.
W83-00662

MANAGING WATER QUALITY IN CHANNEL CATFISH PONDS,
Auburn Univ., AL. Dept. of Fisheries and Allied Aquacultures.
For primary bibliographic entry see Field 5G.
W83-00666

INFLUENCE OF TEMPERATURE AND RIVER DISCHARGE ON WATER QUALITY OF THE WESTERN SCHELDT ESTUARY,
Brussels Univ. (Belgium). Lab. of Oceanography.
M. Somville, and N. De Pauw.
Water Research, Vol 16, No 8, p 1349-1356, August, 1982. 13 Fig, 1 Tab, 13 Ref.

Descriptors: *Water quality, *Estuarine environment, *Temperature effects, Physical properties, River flow, Streams, Scheldt Estuary, Dissolved oxygen, Nitrates, Nitrification, Oxygen, Ammonium, *Belgium, Western Scheldt estuary.

The evolution of the oxygen, nitrate and ammonium concentrations over a 15 year period were studied in relation to variations of hydrodynamical (river discharge) and environmental (temperature) parameters in the self-purifying part of the Western Scheldt estuary. In the polluted part of the stream, ammonium concentrations over the period 1967-1977 have also been considered. Oxygen, ammonium concentrations, and the start of the nitrification process were found to be yearly cyclic parameters, indicating the strong relationship between water quality and environmental parameters. After eliminating the effect of environmental parameters on water quality, it was demonstrated that neither the ammonium concentration in the polluted part of the Scheldt estuary, nor the self-purification parameters, dissolved oxygen and nitrification, in the recuperating part of the stream, have changed significantly during the study periods of 1967-77, 1964-79, and 1973-77, respectively. It was concluded that, in order to assess improvement or deterioration of the water quality in an estuary, all parameters related to the self-purification process (oxygen, nitrate) or organic load breakdown (ammonium) must be considered at the same time as the hydrodynamical parameters, such as river discharge and temperature. (Baker-FRC)
W83-00669

THE RESPONSE OF A PERCH, PERCA FLUVIATILIS L., POPULATION TO EUTROPHICATION AND ASSOCIATED CHANGES IN FISH FAUNA IN A SMALL LAKE,
Reading Univ. (England).
P. R. Bregazzi, and C. R. Kennedy.
Journal of Fish Biology, Vol 20, No 1, p 21-31, January, 1982. 3 Fig, 2 Tab, 41 Ref.

Descriptors: *Fish populations, *Eutrophication, Lakes, Slapton Ley, Fish management , Growth, Aquatic life, *Perch, Fisheries, Natural waters, *United Kingdom.

Dynamic changes in the fish population of Slapton Ley were investigated. Various parameters associated with the perch population were studied in depth as this environment was subjected to increasing eutrophication. The study revealed no adaptive responses to the increasing eutrophication had taken place. The growth rate of perch up to the age of III had only slightly declined and there was a marked preponderance of young fish. Relative growth rate was consistent in spite of the population decline. No dominant year class was apparent. Mean instantaneous mortality rate and annual survival rate were calculated, and the length-weight relationship was analyzed. Feeding strategy had not altered since an earlier study in the 1970s. A decline was noted in the percentage of perch maturing at early age. Ripeness coefficients and fecundity estimates were calculated. A previously documented spawning migration was confirmed. The findings of this study are atypical for a declining perch population, changes observed not being adaptive and not conforming to theoretical prediction or practical expectation. While the reasons for this singularity of experience at Slapton are not known, their implications for proper management of fish and natural waters are considerable. (Baker-FRC)
W83-00678

5D. Waste Treatment Processes

RAPID INFILTRATION TREATMENT OF PRIMARY AND SECONDARY EFFLUENTS,
Camp Dresser and McKee Inc., Denver, CO.
R. R. Carlson, K. D. Linstedt, E. R. Bennett, and R. B. Hartman.
Journal of the Water Pollution Control Federation, Vol 54, No 3, p 270-280, March, 1982. 13 Fig, 3 Tab, 8 Ref.

Descriptors: *Land disposal, *Wastewater treatment, Infiltration, Secondary wastewater, Nitro-

gen removal, Phosphorus removal, Water reuse, Water quality, Coliforms, Chemical oxygen demand, *Colorado, Boulder.

Primary and secondary effluents were applied to a rapid infiltration system during different project phases in an effort to assess the relative capabilities of the system for providing either tertiary treatment or a combined secondary and tertiary treatment in a single treatment stage. The trickling filter plant used in the study is located in Boulder, Colorado. The soil at the site is of the Niwot Series, consisting of loam, sandy loam, or clay loam to a depth of 1 to 3 feet, below which coarse gravel and sand extend to the bedrock formation, which is found at a depth of 8 to 10 feet. The three basins were loaded at a rate of 100, 42, and 160 feet per year of secondary effluent and at a rate of 50, 144, and 120 feet per year of primary effluents, respectively, during separate phases of the tests. The rapid infiltration system was shown to be capable of providing a high quality renovated water with minimum pretreatment prior to application to the rapid infiltration basins. The infiltration rates on the rapid infiltration basins were higher when primary effluent was applied to the system than when secondary effluent was applied. No operational or aesthetic difficulties related to the application of primary effluent to the rapid infiltration basins occurred during a 1-year test period. The chemical oxygen demand of the renovated water was essentially the same for both primary and secondary effluent applications. A consistently low level of phosphorus in the renovated water was achieved when the rate of phosphorus application to the rapid infiltration system was consistent with the rate of the long-term removal mechanisms. Virtually all of the nitrogen applied to the three basins was oxidized by nitrification and discharged as nitrate nitrogen in the renovated water, resulting in occasional excesses of nitrate levels in the renovated water. Although the basins provided major reductions in fecal coliform concentrations, disinfection would be required prior to discharge of the renovated water to a surface water system. (Carroll-FRC)
W83-00358

VELOCITY-DEPENDENT REACTION RATES IN A SLIME REACTOR,
Engineering-Science Inc., Austin, TX.
F. J. Castaldi, and J. F. Malina, Jr.
Journal of the Water Pollution Control Federation, Vol 54, No 3, p 261-269, March, 1982. 8 Fig, 35 Ref.

Descriptors: *Biological wastewater treatment, *Slime, Microbial degradation, Biomass, Kinetics, *Wastewater treatment, *Reynolds Number.

The nature of the diffusion kinetic phenomenon in a microbial slime reactor was investigated, with emphasis on the equilibrium reactor rate observed in laboratory scale slime reactors. Convective diffusion with reaction in microbial slime reactors was studied over Reynolds Numbers ranging from laminar to turbulent flow, in both a random and a continuous manner. The data indicated that the observed reaction rate in a microbial slime reactor is a function of velocity intensity and the substrate concentration in the bulk stream and that the turbulence level in the reactor is the parameter of greatest concern. An apparent abrupt change in the physical properties of the system occurs at a critical magnitude of the Reynolds Number. Below the observed limiting oxygen concentration, the apparent uptake rate was found to be primarily a surface reaction, regardless of the magnitude of the velocity intensity. As a result, solids retention time and quantity of biomass are not a primary concern when a microbial slime reactor is operating under laminar flow conditions. (Carroll-FRC)
W83-00359

CONTROL OF ALGAL FILAMENTOUS BULKING AT THE SOUTHERLY WASTEWATER TREATMENT PLANT,
Delaware Univ., Newark. Dept. of Civil Engineering.
A. F. Rozich, R. M. Sykes, G. B. Walkenshaw, and D. R. Rodgers.
Journal of the Water Pollution Control Federation, Vol 54, No 3, p 231-237, March, 1982. 2 Fig, 7 Tab, 16 Ref.

Descriptors: *Algal control, *Sludge bulking, *Wastewater treatment, Activated sludge, Cyanophyta, Algae, Aeration, Fatty acids, Industrial wastewater, Dissolved oxygen, *Ohio, Columbus.

The Southerly Wastewater Treatment Plant in Columbus, Ohio, has experienced algal filamentous bulking of its activated sludge during the late summer and early fall of each year since 1971. The cyanobacterium Schizothrix calcicola is responsible for this bulking. Laboratory studies have shown that S. calcicola is kinetically limited by acetate, proliferating only in plug-flow reactors having limited but not anoxic inlet-end dissolved oxygen concentrations, and that high volatile fatty acid concentrations were needed in the influent water for bulking to occur. A full-plant scale demonstration was designed to investigate whether the bulking could be controlled by eliminating one or both of the two causes. Conversion of Southerly's mixed liquor aeration tanks from strict plug flow to distributed load configurations did not result in control of bulking. Installation of additional diffusers in the aeration tanks permitted maintenance of an averaged dissolved oxygen of 0.8 milligrams per liter at the tank inlets, even under strict plug flow conditions. This approach was more effective in controlling bulking than load distribution plus chlorination of the return sludge. When increased aeration was accompanied by a reduction in the influent volatile fatty acids, which was achieved by restricting the flow of brewery wastes into the plant, filamentous bulking caused by S. calcicola was effectively controlled. These studies showed that laboratory and pilot plant studies can successfully predict the conditions leading to bulking in full-scale plants if all the important variables affecting the microbes are considered. (Carroll-FRC)
W83-00369

FATE OF VIRUS IN WASTEWATER APPLIED TO SLOW-INFILTRATION LAND TREATMENT SYSTEMS,
Army Medical Bioengineering Research and Development Lab., Fort Detrick, MD.
For primary bibliographic entry see Field 5B.
W83-00386

THE THEORY AND DESIGN OF AEROBIC BIOLOGICAL TREATMENT,
Akademiya Nauk SSSR, Moscow. Inst. Vodnykh Problem.
V. A. Vavilin.
Biotechnology and Bioengineering, Vol 24, No 8, p 1721-1747, August, 1982. 15 Fig, 1 Tab, 25 Ref.

Descriptors: *Biological treatment, *Design criteria, *Aerobic treatment, Model studies, Kinetics, Biomass, Aeration, Trickling filters, Rotating disks, *Wastewater treatment.

Analysis of experimental data shows that high-level and rough treatment of sewage water are described by different equations. The classical Monod model is adequate for rough treatment. High concentrations of a pollutant saturate the biomass, and the general oxidation process follows a zero-order for the substrate. For high-level treatment, the model of an n-order ($n > 1$) for the substrate is usable. General models for aerobic treatment, proposed in this paper, are independent of reactor type (aeration tank, trickling filter, or rotating disk). The models use only 3 coefficients: pmax, the maximal specific rate of the treatment process; ks, the half-saturation constant, and n. (Cassar-FRC)
W83-00413

URBAN RUNOFF CONTROL TECHNOLOGY,
Ontario Ministry of the Environment, Toronto.
G. Zukovs, D. G. Weatherbe, and J. Marsalek.
Civil Engineering (New York), Vol 52, No 8, p 50-52, August, 1982. 3 Fig, 1 Tab.

Descriptors: *Urban runoff, *Storm water, *Flow control, Runoff, Controlled drainage, Wastewater treatment, Inlets, Underground storage, Water storage, Storm sewers, *Ontario, Controlled storage, Storage, Bacteria, Drainage, Ponds, Storm runoff, Storm wastewater, Coliforms.

A variety of controls for urban runoff quantity and quality has been used in the Ontario region. These include inlet controls to restrict flow to sewers during high, intense precipitation or to permit overland drainage where feasible and underground storage or pond storage in parks and other locations. Studies on storm water treatment of pollutants revealed that 10 hours of quiescent settling or alum flocculation with 2 hours quiescent settling were effective in removing pollutants. Bacterial levels were not significantly reduced by natural settling, but dosage of 5 mg per liter available Cl reduced fecal coliforms to less than 10 per 100 ml. (Cassar-FRC).
W83-00416

NEW EVAPORATION PROCESS: KEY TO ZERO DISCHARGE FOR ELECTROPLATERS.
Civil Engineering (New York), Vol 52, No 8, p 58-59, August, 1982. 2 Fig.

Descriptors: *Vapor compression distillation, *Chromium, *Electroplating, *Wastewater treatment, Zero discharge, Metal-finishing wastes, Industrial wastewater, Water reuse, Evaporation.

A vapor-recompression evaporation process was installed at the Navy's Pensacola Rework facility in 1981 to provide zero discharge treatment for chromium electroplating wastes. In this closed system the chromic acid laden rinse water is evaporated to a concentration equal to that of the original plating bath and is recycled. Evaporated water is condensed for reuse as rinse water. No chemical addition is necessary, and no sludge is generated. The process requires only 1/12 the energy of normal evaporation processes. Capital investments for vapor-recompression evaporation are slightly higher than the precipitation-clarification process, but evaporation operating costs are 15% lower. (Cassar-FRC)
W83-00417

LIME IN WASTEWATER TREATMENT,
British Quarrying and Slag Federation Ltd., Croydon (England).
A. S. Anthony.
Effluent and Water Treatment Journal, Vol 22, No 6, p 244, June, 1982. 3 Ref.

Descriptors: *Wastewater treatment, *Lime, Sludge conditioning, Chemical reactions, United Kingdom, Water pollution control, Industrial wastes, Bacteria, Phosphates, Organic matter.

The use of lime in the removal of impurities from wastewater, including sewage and industrial effluent is briefly noted. In many areas of the United Kingdom, water is reused several times before making its way to the sea. Treatment works employ mechanical, biological, and chemical processing to produce, at the lowest possible cost, a discharge of the required standards and byproducts which can be handled and disposed of without causing nuisance to the general public. Chemicals are added to sewage effluent to modify the ionic state of the dispersed phase so that agglomeration is encouraged and settling or filtration techniques can be used efficiently to effect separation and to combine chemically with active materials to reduce the pollution potential. Combinations of lime with other chemicals are often used to enhance performance. Lime has been used in the United Kingdom for the treatment of sewage and industrial wastes for more than 100 years. It is available as quicklime (calcium oxide) or hydrated lime (calcium hydroxide). The major use of lime in sewage treatment is in the conditioning of sludge prior to mechanical dewatering. Substantial quantities of lime are also used in the chemical treatment of industrial effluent at source to remove toxic compounds and heavy metals and to adjust the pH of the effluent to a level suitable for sewage treatment processes or discharge into water courses or rivers. Lime also ensures that the biological process is not overloaded or reduced in efficiency by

toxic materials. Lime serves as a coagulant in primary sedimentation to improve throughput rates and to assit in the removal of greases and fats which can cause trouble later. Lime used to treat raw sewage rather than secondary effluent not only removes phosphates but also enables removal or a large portion of organic material present in suspension. (Baker-FRC)
W83-00427

FATE AND DISTRIBUTION OF A QUATERNARY AMMONIUM SURFACTANT, OCTADECYLTRIMETHYLAMMONIUM CHLORIDE (OTAC), IN WASTEWATER TREATMENT,
Procter and Gamble Co., Cincinnati, OH. Packaged Soap and Detergent Div.
L. M. Games, J. E. King, and R. J. Larson.
Environmental Science and Technology, Vol 16, No 8, p 483-488, August, 1982. 4 Fig, 4 Tab, 16 Ref.

Descriptors: *Surfactants, *Biodegration, *Activated sludge process, Fate of pollutants, *Wastewater treatment, Detergents, Degradation, Linear alkyl sulfonates, Mineralization, *Quaternary ammonium compounds, Octadecyltrimethylammonium chloride.

The distribution and transformation of alkyl and methyl C14-labeled octadecyltrimethylammonium chloride (OTAC), a quaternary ammonium surfactant, were studied in a laboratory scale activated sludge system. OTAC was adsorbed to the wastewater solids and biodegraded rapidly at initial concentrations of 0.1 to 20 mg per liter. More than 99% of the OTAC was adsorbed within 30 min of addition; biodegradation was slower and followed first-order kinetics. A mixture of 20 mg per liter each of OTAC and linear alkylbenzene sulfonate followed first-order kinetics after a 2-3 day lag period. The half life for OTAC primary biodegradation kinetics, based on the first-order biodegradation rate constant, was 2.5 hours. Mineralization of the methyl and alkyl carbons was slower, with half lives of 28 and 40 hours, respectively. (Cassar-FRC)
W83-00433

SOME OPTIONS FOR TREATING LIQUID WASTES FROM NITROGEN FERTILIZER FACTORIES,
L. D. Roland.
Effluent and Water Treatment Journal, Vol 22, No 6, p 216-220, June, 1982. 3 Fig, 3 Tab, 7 Ref.

Descriptors: *Wastewater treatment, *Nitrogen compounds, *Fertilizers, Agricultural chemicals, Urea, Industrial wastes, Ammonium nitrate, Nitrates, Absorption, Reverse osmosis, Chemical reactions, Evaporation, Precipitation, Steam stripping, Distillation, Shock loads.

With nitrogen fertilizer waste there exists the possibility of recovery and return of part of the effluent for reuse. During the manufacture of the two major nitrogen fertilizers, urea and ammonium nitrate, water is a product of each reaction and is removed in later stages by evaporation, giving rise to a distillate contaminated with fertilizer. In many older plants nitrogen bearing wastewater also arises from leakages and washdowns. Dust emissions can also be contaminated leading to rainwater run-off problems. Treatment of urea wastes may include a biological one which is a nitrification step followed by denitrification, both steps including activated sludge recycling and clarification. Other methods include absorption, treatment with nitric oxide, hydrolyzer stripper or evaporative scrubber. Ammonium nitrate wastes present more difficult pollution problems. Ion exchange was viewed as the best approach, with the choice being between a fixed bed and a continuous system. Alternative treatments included reverse osmosis, steam stripping, precipitation, distillation, evaporative scrubber, and biological treatment. Difficulties with shock loads, required start up time, and the temperature dependance of bacteria activity are discussed. (Baker-FRC)
W83-00440

POLLUTION FROM US EXPLOSIVES AND PROPELLANTS PRODUCTION,
L. K. Wang, M. H. Wang, V. J. Ciccone, and R. G. Ross.
Effluent and Water Treatment Journal, Vol 22, No 6, p 222-223, 225, June, 1982. 2 Tab, 18 Ref.

Descriptors: *Explosives, *Propellants, *Industrial wastes, Phossy water, TNT, Phosphorus, *Nitrocellulose, Nitroglycerin, Hazardous materials, Munitions, *Wastewater treatment.

Nitrocellulose is a principal ingredient of all propellants, and is made by treating cotton linters or wood pulp cellulose with mixed nitric and sulfuric acids. Following the reaction, the processed material is wrung, then 'drowned' in water for the removal or most of the acids. The crude product is subjected to a 70 hr prolonged boiling with dilute sulfuric acid and subjected to several purification steps. A large amount of process water is needed, most of which is discharged as wastewater containing nitrocellulose fine particles and considerable amounts of sulfuric and nitric acids. While only a minimal toxicological hazard has been associated with nitrocellulose fines in water, since it does occur as a colloid and is not amenable to biodegradation, physicochemical pretreatment of such wastewaters is considered necessary prior to any biological treatment system. In the production of nitroglycerin, about 0.50 gallons of process water are used per pound of product produced in the batch manufacturing process. Insofar as nitroglycerin is a dissolved pollutant, it is presumed to be carried by the streams without settling in reservoirs or lakes. The production of TNT also results in significant quantities of wastewater containing hexantrinitrodibenzyl, tetranitromethane, cyanic acid, trinitrobenzoic acid dinitrocresol, phenol, and various nitrotoluene sulfonic acids. Phossy water is a term for waters coming into direct contact with large quantities of molten phosphorus. When phossy water is discharged into a receiving water and an adequate time allowed, the white phosphorus particles may settle out and the dissolved phosphorus will slowly oxidize. (Baker-FRC)
W83-00441

BRIGHTEN THE BEDS,
C. A. Smith.
Effluent and Water Treatment Journal, Vol 22, No 6, p 231-232, June, 1982. 1 Tab.

Descriptors: *Public relations, *Wastewater facilities, *Cleanup, Fungi, Molds, Operating policies, Maintenance, Administration.

Due to increasing frequency of visits to wastewater treatment plants by visitor tour groups, different ways are explored of making the plant a more pleasant place to tour. In particular, the structures on and around the beds could be brightened up to look more presentable. One of the major problems is to select a paint that will resist microbe attack. Twenty species of mold were isolated when scientific tests were carried out, and a number of typical paint systems were selected and applied to toughened glass tubes in an atmosphere of an aqueous suspension of spores. Paints showing no growth after the two test periods were those containing zinc chromate, zinc oxide and phenolic resin/tung oil. The stability of fungicides has also been studied by brushing paints containing the fungicides and corresponding blanks on polyethylene - terephthalate polyester films which were attached to both sides of asbestos cement panels and exposed to humid conditions. The growth of mold has been found to be very much dependent on local environmental conditions, including food supply, humidity, temperature, and combinations of these. Use of mercurials and, to a lesser extent, phenolic biocides as assitives has provided adequate protection at reasonable cost. However, the toxicity of some of these compounds has produced some tragic incidents. In the treatment of mold which is already established, the surface should first be vacuum cleaned, brushed, and scraped, then washed down with 2% aqueous sodium pentachlorophenate followed by clean water, then dried. Dilute hypochlorite solution may also be suitable for mold growth treatment. (Baker-FRC)
W83-00442

DESTRUCTION OF POLLUTANTS IN WATER WITH OZONE IN COMBINATION WITH ULTRAVIOLET RADIATION. 1. GENERAL PRINCIPLES AND OXIDATION OF TETRACHLOROETHYLENE,
North Texas State Univ., Denton. Dept. of Chemistry.
For primary bibliographic entry see Field 5F.
W83-00446

UPRATING SLUDGE TREATMENT PROCESSES,
Water Resources Council Process Engineering, (England).
For primary bibliographic entry see Field 5E.
W83-00462

REMOVING METALS FROM WASTE SOLUTIONS WITH LOW RANK COALS AND RELATED MATERIALS,
Cullen (G. V.) and Associates, North Balwyn (Australia).
G. V. Cullen, and N. G. Siviour.
Water Research, Vol 16, No 8, p 1357-1366, August, 1982. 13 Tab, 20 Ref.

Descriptors: *Metals, *Coal, *Calcium hydroxide, *Wastewater treatment, Industrial wastewater, Ion exchange, Heavy metals, Peat, Sawdust, Lignite, Organic matter, Lime, Mine drainage, Metal-finishing wastes.

A method for removing metals from industrial wastes, such as mine drainage water and spent solutions and effluents from metallurgical and metal-finishing processes, was developed. Brown coal, peat, lignite, and sawdust were treated with lime slurry to load the carbonaceous media with Ca(++) ions, forming an ion exchange media. Optimum Ca loading was 19.1% on brown coal at 80 min contact time with lime slurry. The best loadings on other materials (1000 min contact time with a clarified Ca(++) solution) were sawdust, 8.6%; lignite, 10.9%; and peat, 12.4%. Metals removals from solutions at concentrations of 1000 mg or less on brown coal with Ca loading of 15.2%, contact time of 1000 min, and liquid:solid ration of 10:1 were 99.7% or greater for Zn, Pb, Cu, Al, Fe, Hg, Cd, U, Ni, Ag, and Co; 97.6% or greater for Mn, Ge, and Sb; and 92% for V. Cr(3+) and Cr(6+) were removed at 99.8% and 97.7%, respectively, at different contact times and liquid:solid ratios. The above conditions applied to Cu and the other carbonaceous materials produced removals of > 99.2% for brown coal, lignite, sawdust, and peat. pH below 3 sharply decreased metals removals at higher loadings. Metals removals were on the order of 89-99.99% in treatment of 2 industrial wastes containing a combination of heavy metals in solution. Effluents contained metals levels comparable to those reported for other purification processes. The method may be applied either by stirring the Ca-loaded media in a batch of waste solution and filtering or by passing through packed beds in a contiuous process. (Cassar-FRC)
W83-00471

A SOLUTION TO SCREENINGS PROBLEMS BY DEWATERING AND INCINERATION,
Wessex Water Authority (England).
D. W. Pace, and G. J. Price.
Water Pollution Control, Vol 81, No 3, p 358-371, 1982. 2 Fig, 10 Tab, 1 Ref.

Descriptors: *Dewatering, *Incineration, *Filtration, Sludge disposal, Screens, Wastewater treatment, *England.

A screenings dewaterer was installed at Blackwell Hams Works, Chippenham, England, to handle severe blockages in the pressure filtration plant. Problems resulted from balling up of non-degradable plastics and man-made materials in the screenings. The apparatus is a rectangular welded steel frame 1 m high x 1.5 m wide x 4.6 m long on which is mounted a screening/washwater tank feeding in turn into a macerator, a pump, and the dewaterer itself. The dewaterer consists of 2 semicircular perforated steel plate drainage areas, the

first for draining excess water and the second for squeezing out further water with rubber rollers. The product looks like thin pieces of paper pulp about 100 mm x 50 mm x 3 mm, relatively free of fecal and organic matter. The screenings are bagged in plastic sacks and incinerated. Detailed operating data for the dewaterer and incinerator are given. (Cassar-FRC)
W83-00473

OXYGEN INJECTION INTO A RISING MAIN: ITS EFFECT ON PUMPING,
R. Carne, G. F. Clough, and S. Newcombe.
Water Pollution Control, Vol 81, No 3, p 399-411, 1982. 12 Fig, 3 Tab, 6 Ref.

Descriptors: *Oxygenation, *Pumping, *Energy loss, *Wastewater treatment, Hydrogen sulfide, Monitoring, Static head, Cost analysis, Operating costs, Pipes, Pipe flow, Bath, *England.

Oxygen injection into a sewage rising main produced good treatment results in the Bath, England, plant, but gas-locking in the main increased pumping costs by 50%. The oxygen was injected to control sulfide and to partially treat the sewage. Several conclusions were made after an investigation. Gas pockets could form at downward gradients with or without oxygen injection, but were larger with oxygen injection. This increased the static head, reduced pumping rates, and increased power consumption. Localized gas bubbles also increased losses and reduced pumping rates. The degree of gas-locking depended on: rate of oxygen injection, degree of oxygen dispersion at injection points, velocity of sewage flows, pump/pipeline characteristics, and air valve effectiveness. Power consumption was lowered to only 20% over the non-oxygen injection use by changing locations of the oxygen injection points and replacement of worn pump impellers. Other possible changes include modifying the pump control system, avoiding over-injection of oxygen, relocating the oxygen injection points, replacing existing air valves with more effective ones, and regular monitoring of pressure, flow, and power consumption. (Cassar-FRC)
W83-00474

FIRST IMPRESSIONS OF A NOVEL AERATION SYSTEM FOR ACTIVATED SLUDGE PLANTS,
A. P. Hopwood, and L. M. Barnes.
Water Pollution Control, Vol 81, No 3, p 412-424, 1982. 3 Fig, 9 Tab, 15 Ref.

Descriptors: *Activated sludge process, *Aeration, *Wastewater treatment, Biological wastewater treatment, Venturators, Isleham, *England, Nitrification.

The contact stabilization plant at Isleham, England, was modified by installation of Venturator aeration units to improve performance. There had been problems with low levels of nitrification, blocked lines, and excessive BOD loading. Four months of trials showed that dissolved oxygen of more than 1 mg per liter could be maintained, and the plant could be satisfactorily operated at twice the recommended BOD loading. Effluent quality was significantly improved: average suspended solids, 15 mg per liter, and BOD, 19 mg per liter. Nitrification was 50% and BOD removal, 92.2-97.6%. (Cassar-FRC)
W83-00475

A COMPARISON OF THE CARROUSEL AND PASVEER DITCH ACTIVATED SLUDGE PLANT,
Wessex Water Authority, (England).
C. R. Mulready, D. C. Payne, and D. W. Watkins.
Water Pollution Control, Vol 81, No 3, p 297-307, 1982. 6 Fig, 5 Tab, 6 Ref.

Descriptors: *Oxidation ditches, *Aeration, *Activated sludge process, Ditches, Carrousel ditches, Pasveer ditches, Dissolved oxygen, *Wastewater treatment, Performance evaluation.

Oxidation ditch installations at two activated sludge plants were compared. The Carrousel system produced a better and consistently higher quality effluent than the Pasveer ditch system. Although both are extended aeration systems, there are several differences. The Pasveer ditch system is a uniform channel 1.0-1.8 m deep. The aerator has a TNO rotor with rows of blades arranged around a horizontal center shaft, sited anywhere along the ditch. The depth of immersion is controlled by adjusting the outlet weir height. The Carrousel system is a uniform channel 2 m deep with 3 m deep aeration pockets. The vertical aerators, with eight vanes projecting from a center shroud, is above the deep section of the ditch. Depth is controlled by a jacking screw on the vertical shaft. In the Carrousel system the anoxic zones and dissolved oxygen were easier to control than in the Pasveer system. (Cassar-FRC)
W83-00476

DENITRIFICATION,
Metropolitan Sanitary District of Greater Chicago, IL.
T. B. S. Prakasam, and M. Krup.
Journal of the Water Pollution Control Federation (Literature Review Issue), Vol 54, No 6, p 623-631, June, 1982. 122 Ref.

Descriptors: *Denitrification, *Literature review, *Wastewater treatment, *Water treatment, Soil bacteria, Sludge, Denitrifying bacteria, Bacteria, Microbiological studies, Slurries, Growth systems, Effluents, Patents, Water pollution control.

Publications covering major aspects of denitrification are reviewed. Several studies on the nature and behavior of denitrifying populations in soil, water, and wastewater ecosystems appeared, as well as investigations on conditions affecting the type and growth of bacteria in various types of sludge and wastewater. Studies of denitrification rates in coastal waters were noted. Works on slurry processes included reviews of the stoichiometry of denitrification and its significance in wastewater management, conditions affecting the denitrification rate, and the results of several denitrification systems. Attached growth processes reviewed included fixed beds, suspended growth systems, fluidized sand bed reactors, ion exchange, biological fluidized bed denitrification, blending with water from another source, provision of storage reservoirs to retain water of low nitrate from the same source, activated sludge, sand filters, the Ruck system, an upflow sludge blanket reactor utilizing the carbon found in wastewater, stirred bed reactors, and an immersed bed packed with plastic media. Soil denitrification studies covered conditions affecting denitrification rates, leaching, soil-turf filters, and the influence of Spartina alterniflora. Patents were issued for several attached and suspended growth systems, including denitrification processes using methanol as the hydrogen donor, the use of N2 gas evolved in the denitrification process to concentrate sludge by flotation, and a process in which a portion of the NH4-N in wastewater was subjected to ammonia stripping, while the remainder was nitrified and then denitrified. (Gish-FRC)
W83-00480

OPERATION AND MAINTENANCE OF WASTEWATER SYSTEMS INCLUDING INSTRUMENTATION AND AUTOMATION,
Lehigh Univ., Bethlehem, PA. Center for Marine and Environmental Studies.
I. J. Kugelman, J. Houthoofd, and W. Schuk.
Journal of the Water Pollution Control Federation (Literature Review Issue), Vol 54, No 6, p 642-646, June, 1982. 73 Ref.

Descriptors: *Wastewater treatment, *Wastewater facilities, *Maintenance, *Operation, *Literature review, Automation, Process control, Training, Sensors, Pollutant identification, Model studies, Computers, Activated sludge.

Publications concerning the operation and maintenance of wastewater systems are reviewed. General papers comprised a literature review and two conferences, while recent studies focused on poor compliance with discharge standards and inadequacies in preliminary treatment, sludge handling, and instrumentation. Operator training was discussed in manuals on the skills needed by operators, suggestions for training programs, use of outside operation and maintenance consultants, and the role of training in start-up. Most studies on process control and operation of treatment processes focused on activated sludge. Reliance on grab samples, continuous measurement, dissolved oxygen control, on-line sludge sedimentation tests, and separate handling of waste activated and primary sludge were addressed. Instrumentation research covered the application of instrumentation to process control, sensors for in-line or on-line use in a wastewater treatment plant, flowmeters and other flow measurement procedures, and the problems of monitoring priority pollutants. Models of treatment processes included a nonlinear mathematical model of a six-unit treatment plant, time-dependent models of activated-sludge and nitrification systems, and stochastic models. Papers describing the application of computers for various functions were generally applicable to wastewater systems. Works on the use of computer control, operation, and maintenance also appeared. Miscellaneous publications considered odor control, foam control, and preventive maintenance programs. (Gish-FRC)
W83-00481

ONSITE ALTERNATIVES FOR TREATMENT AND DISPOSAL,
Wisconsin Univ.-Madison.
W. C. Boyle, and R. J. Otis.
Journal of the Water Pollution Control Federation (Literature Review Issue), Vol 54, No 6, p 637-642, June, 1982. 50 Ref.

Descriptors: *Waste disposal, *Literature review, *Wastewater treatment, *On-site investigations, Domestic wastes, Animal wastes, Solid wastes, Developing countries, Subsurface disposal systems, Septic tanks, Path of pollutants, Wastewater management, Sanitation, Sewer systems, Wastewater facilities.

A literature review concerning the onsite treatment and disposal of wastes is presented. Two conferences, one in the U.S. and one in Nigeria, are cited. Onsite treatment studies included the application of flow-reduction methods, use of intermittent sand filters to treat household wastewater, characteristics of septage and the effects of its land application. Works on subsurface disposal systems focused on the attenuation of pollutants in soil, the performance of such systems, system design, and the rehabilitation of ineffective systems. Some works covered alternative systems made necessary by unfavorable topography and geology. These systems included mounds, narrow trenches, composting toilets, and subsurface, surface, and evaporation disposal methods. Management papers covered the current program for small alternative wastewater systems and the involvement of the EPA, along with guidelines on discrete sewerage facilities in the San Francisco Bay area. Publications on small community facilities were concerned with costs, selection of the most appropriate wastewater treatment techniques and optimum management. Thirteen works covered sanitation in developing countries and focused on guidelines and design tools for engineers and sanitarians; current knowledge on the health aspects of waste; the sociocultural aspects of water supply and excreta disposal; practical suggestions for sanitation in Vietnam and in Africa; evaluations of and treatment alternatives for current methods of waste management in developing countries; and the design of latrines and toilets. (Gish-FRC)
W83-00482

SLUDGE TREATMENT, UTILIZATION, AND DISPOSAL,
Duke Univ. Durham, Dept. of Civil Engineering.
For primary bibliographic entry see Field 5E.
W83-00483

BIOLOGICAL FILTERS,
Massachusetts Univ., Amherst. Dept. of Civil Engineering.
M. S. Switzenbaum.

Journal of the Water Pollution Control Federation (Literature Review Issue), Vol 54, No 6, p 592-599, June, 1982. 1 Tab, 84 Ref.

Descriptors: *Wastewater treatment, *Biological filters, *Filters, *Literature review, Rotating biological contactors, Model studies, Nitrification, Energy, Anaerobic digestion, Stability analysis, Activated carbon, Fluidized beds, Aerobic treatment, Fermentation, Denitrification, Trickling filters.

The use of biological filters in wastewater treatment is reviewed. Ten works dealt with rotating biological contactors (RBC), several stressing the lower energy consumption of RBC compared with conventional activated sludge. The topic of nitrification with the RBC was covered, as was the use of RBC for industrial wastes and supplemental aeration and chemical feed to maintain optimal pH. Studies on anaerobic filters included the ANFLOW (anaerobic, upflow) procedure for the energy-efficient secondary treatment of municipal wastewater, the use of the anaerobic filter for energy production and pollution control of high-strength wastes, the stability of these filters under shock loading conditions, the advantages of anaerobic fixed film systems, and the use of anaerobic filters with granular activated carbon as the contact medium for phenol-containing wastewater treatment. Works on fluidized bed/expanded bed reactors considered aerobic systems, anoxic denitrification systems, or anaerobic fermentation systems. Articles on trickling filters included a forced-air down-draft filter with computer-controlled recycle for nitrification, filter performance, a simple method of analyzing retention time, the use of rigid PVC sheet material to replace rocks, and the characterization of oxygen transfer on filter slime. Fixed-film processes covered the effect of inorganic compounds in fertilizer-industry wastewater on nitrification and the wetting and stability of a plastic filter medium. Multistage systems were also discussed. (Gish-FRC)
W83-00484

LAGOONS AND OXIDATION PONDS,
Lubbock Christian Coll., TX. Inst. of Water Research.
D. B. George.
Journal of the Water Pollution Control Federation (Literature Review Issue), Vol 54, No 6, p 610-612, June, 1982. 17 Ref.

Descriptors: *Lagoons, *Oxidation ponds, *Wastewater treatment, *Literature review, Design criteria, Performance evaluation, Stabilization ponds, Heavy metals, Animal wastes, Energy, Infiltration, Sand filters, Odor control, Suspended solids, Overland flow.

The use of lagoons and oxidation ponds in wastewater treatment is reviewed. A position paper on the regulation of waste stabilization pond systems evaluated effluent total suspended solids composition and its impact on reveiving waters. Net rainfall data, used for the design of lagoons for livestock-wastes treatment, were presented for 78 locations in 20 states. Works on process performance included the use of laboratory-scale two-cell lagoon systems to determine lagooning characteristics of swine and settled dairy waste; the effects of wastewater, water temperature and detention time on performance; an article indicating that heavy-metal accumulation was not a limiting factor in the design of oxidation ponds used to propagate tilapia; and several publications on the fate of pathogens in waste stabilization ponds. The section on upgrading of lagoons considered the energy requirements for alternative methods of treating wastewater flow rates of 190-19,000 cu m/day, a pilot rapid infiltration wastewater treatment system, the use of overland flow to upgrade municipal facultative lagoon effluent, the use of intermittent sand filters to increase performance, odor control methods, and oxygen sources for stabilization ponds. Two process models are reviewed: dye tracer studies and model simulations to predict the treatment efficacy of waste-stabilization-pond geometries and inlet and outlet configurations; and an optimization model to find the least-cost waste treatment facility design for a community that discharges into a stream with low drought stream flows. (Gish-FRC)
W83-00485

PHYSICAL AND CHEMICAL METHODS,
Florida Univ., Gainesville. Dept. of Environment Engineering Sciences.
E. L. Melear, and J. Zoltek, Jr.
Journal of the Water Pollution Control Federation (Literature Review Issue), Vol 54, No 6, p 584-892, June, 1982. 140 Ref.

Descriptors: *Wastewater treatment, *Chemical treatment, *Physicochemical treatment, *Literature review, Coagulation, Flocculation, Sedimentation, Filtration, Flotation, Phosphorus removal, Adsorption, Activated carbon, Ion exchange, Membrane processes, Osmosis, Cellulose acetate membranes, Reverse osmosis, Oxidation, Wastewater oxidation.

General and specific aspects of physical and chemical methods of wastewater treatment are covered in this literature review. General articles concern treatment plants combining several methods, focusing on costs and on the theory and practice of ammonia stripping. Coagulation and solids separation was considered in theoretical presentations on flocculation/sedimentation systems and in works on the advantages of different chemicals for flocculation, the use of coagulation and flocculation for virus removal, settlers and sedimentation basins, direct filtration, flotation processes, and phosphorus removal. Adsorption was covered by papers presenting theoretical approaches to determining adsorption parameters; works on pilot studies, mathematical applications, and performance in the field of granular activated carbon used to remove organics; phenol adsorption studies; articles on the chemistry of activated carbon procedures; and works on adsorption onto such materials as type A zeolite, chelate resins, and aluminosilicate. Works on ion exchange included a history of the subject with an evaluation of its importance in water and wastewater treatment and new-process reports. Membrane process papers considered reverse osmosis, electrolyte osmosis, tubular membranes of cellulose acetate or polybenzimidazolone, ultrafiltration, and liquid membranes. Publications on oxidative processes included the use of ozone, treating wastewater effluents with chlorine dioxide, the Enercol and ZOP processes, and wet oxidation. (Gish-FRC)
W83-00486

DISINFECTION,
Illinois Inst. of Tech., Chicago. Pritzker Dept. of Environmental Engineering.
For primary bibliographic entry see Field 5F.
W83-00487

EFFECT OF EDTA ON CADMIUM IN ACTIVATED SLUDGE SYSTEMS,
National Cheng Kung Univ., Tainan (Taiwan). Dept. of Environmental Engineering.
J. F. Kao, L. P. Hsieh, S. S. Cheng, and C. P. Huang.
Journal of the Water Pollution Control Federation, Vol 54, No 7, 1118-1126, July, 1982. 12 Fig, 4 Tab, 13 Ref.

Descriptors: *Cadmium, *Chelation, *Accumulation, *Wastewater treatment, Toxicity, Water pollution effects, Activated sludge process, *Ethylenediamine tetraacetic acid, Kinetics, Bioaccumulation, Adsorption, Protein, Amino acids, Oxygen uptake.

Accumulation of Cd(++) in activated sludge was investigated in the absence and presence of ethylenediamine tetraacetic acid (EDTA), a strong chelating agent. In the absence of EDTA Cd(++) accumulated rapidly during the first stages of the experiments, 2-6 hours in the short-term runs (12 hours) and 5 days in the long-term runs (2-3 weeks). This was attributed to nonbiological adsorption of Cd(++) on the biosolids. Following the initial rapid rate of uptake (rate constants 0.44-0.71 per day for the long-term runs) the rate constant in the second stage remained at 0.08 per day. An adsorption isotherm (Cd(++) uptake vs. Cd(++) remaining in the supernatant) produced an S-shaped curve, indicating strong competition between water molecules and Cd(++) species and lateral interaction among adsorbed Cd(++) ions. EDTA addition at ratios of less than 1:1 molar decreased the extent of Cd(++) uptake one order of magnitude but did not affect the rate of uptake. At the molar ratio of 1:1 there was no inhibition of Cd(++) accumulation. The presence of a large quantity of Cd(++) in the sludge reduced COD removal efficiency and increased oxygen uptake rate, amino acid content, and protein content of the sludge. (Cassar-FRC)
W83-00489

OPERATING EXPERIENCE WITH THERMOPHILIC ANAEROBIC DIGESTION,
Los Angeles Bureau of Sanitation, CA.
W. F. Garber.
Journal of the Water Pollution Control Federation, Vol 54, No 8, p 1170-1175, August, 1982. 3 Fig, 3 Tab, 8 Ref.

Descriptors: *Anaerobic digestion, *Sludge digestion, Hyperion Plant, Los Angeles, *California, *Thermophilic digestion, Mesophilic digestion, Pathogens, Digestion, Dewatering, Soil amendments.

Thirty years operating experience in thermophilic digestion at the Hyperion Treatment Plant, Los Angeles, California, is reviewed. Operation was originally mesophilic (32-35C), but the decision to sell the sludge as a soil amendment prompted a switch to half mesophilic and half thermophilic in 1952. When ocean outfall disposal was started in 1957, the process was changed to 1 or 2 of the 18 digestion tanks at 49C and the balance at 32-35C. Since ocean dumping will be discontinued in 1985, the plant will be converted to 100% thermophilic digestion to provide good filtration properties and effective pathogen inactivation. Although 54C is a desirable temperature for pathogen inactivation, the Hyperion plant can presently maintain the required temperature differential of + or - 0.28C only at 49C. Design changes may make operation at 54 or 60C possible. (Cassar-FRC)
W83-00490

FACTORS LIMITING EMULSIFIED LIPID TREATMENT CAPACITY OF ACTIVATED SLUDGE,
Alberta Univ., Edmonton. Dept. of Civil Engineering.
S. E. Hrudey.
Journal of the Water Pollution Control Federation, Vol 54, No 8, p 1207-1214, August, 1982. 8 Fig, 2 Tab, 29 Ref.

Descriptors: *Food processing wastes, *Lipids, *Emulsions, Oil wastes, Grease, Activated sludge process, *Wastewater treatment, Settleability, Adsorption, Protozoa.

Factors limiting the treatability of emulsified lipids by the activated sludge process were evaluated by studying the rate of adsorption of lipids onto microbial floc, the effect of adsorbed lipids upon activated sludge settleability, and the interaction of emulsified lipids with stalked ciliated protozoa. A wastewater containing 400 mg per liter lipids was 80% adsorbed by acclimated activated sludge solids within 20-30 min. Batch settling data indicated that emulsified lipids promoted activated sludge settleability in acclimated sludge. An explanation for this may be the reduction of entrained water content by the lipid, providing a denser, more settleable floc. Stalked ciliates distinctly accumulated lipids in the experiments. Increasing the loading produced an immediate increase in ciliate population, showing their capability to feed directly on the lipid emulsion. Some useful observations relating to design and operation of activated sludge systems with high lipid loadings were obtained: adequate skimming of the secondary clarifier to prevent possible scum formation; a gentle mixing, flocculation stage between the aeration basin and quiescent settling basin; a 2-stage activated sludge process; and high aeration capacity as provided by

pure oxygen or deep shaft activated sludge processes. (Cassar-FRC)
W83-00499

EVALUATION AND COMPARISON OF DIGESTER GAS MIXING SYSTEMS,
Envirex Inc., Waukesha, WI.
P. G. Baumann, and G. L. Huibregtse.
Journal of the Water Pollution Control Federation, Vol 54, No 8, p 1194-1206, August, 1982. 16 Fig, 3 Tab.

Descriptors: *Anaerobic digestion, *Mixing, *Digestion, *Wastewater treatment, Draft tubes, Diffuser boxes, Lances, Performance evaluation.

Performance evaluation of several digester gas mixing systems indicated that each system was capable of maintaining uniform solids concentrations as well as preventing solids accumulation at the floor. The draft tube, multiple sequentially discharged lances, and floor-mounted diffuser boxes were studied under clean water conditions (in the laboratory) and active anaerobic digester conditions (in operating plants). The factors critical to successful mixing were depth of gas discharge and gas flow rate. The draft-tube and floor-mounted diffuser box systems were not as effective in controlling floating solids because energy input was confined to a limited area. The multiple sequentially discharged lance system required the least energy input to maintain proper mixing. Although the diffuser box system was not affected by changes in floating cover position, the inaccessibility of the boxes and piping during operation was a disadvantage. (Cassar-FRC)
W83-00500

SPRINKLER IRRIGATION ANSWERS CITY WASTE PROBLEM,
For primary bibliographic entry see Field 3C.
W83-00574

NEW SLUDGE SYSTEM REDUCES LANDFILLING NEEDS AT WEYERHAEUSER.
Pulp and Paper, Vol 56, No 7, p 124, July, 1982. 1 Fig.

Descriptors: *Activated sludge process, *Wastewater treatment, Pulp and paper industry, Sludge, Sludge dewatering, Waste disposal, Land application.

A new sludge treatment process at Weyerhaeuser Company's Rothschild, Wisconsin sulfite pulp and paper mill has reduced the amount of sludge cake hauled to landfill by as much as 70%. The process uses heat and pressure to partially oxidize wet sludge. Solids volume is reduced substantially and bound water is released to enhance dewaterability. A primary treatment system had been installed at the plant in 1975. Two years later a 10 million gallon/day secondary treatment system was added, consisting of two jet aeration channels, final clarifiers, sludge flotation thickeners, and three belt presses. These improvements reduced biochemical oxygen demand by 95% and suspended solids by 70%. A 20%-solids sludge cake was produced with the three presses. Sludge from the 1975-77 waste treatment system had been sent to a township landfill until that closed. The thermal conditioning system was installed, which produces a sludge cake acceptable to a professionally managed county landfill 15 miles away. Waste activated sludge is pumped to the thermal system at 3.5% solids. Compressed air at 375 psi is supplied to the sludge, which passes to a heat exchanger where it absorbs heat from the outgoing flow of the reactor. Preheated sludge then enters the reactor, where steam is used to raise its temperature to about 390 degrees F. The oxidized sludge then passes to a storage thickening tank for settling. The sludge is dewatered on only one belt press to 39% to 40% solids. This cake is then hauled to landfill. (Baker-FRC)
W83-00586

ANAEROBIC TREATMENT OF AN INDUSTRIAL WASTEWATER CONTAINING ACETIC ACID, FURFURAL, AND SULPHITE,
Kernforschungsanlage Jeulich G.m.b.H. (Germany, F.R.). Inst. fuer Biotechnologie 2.
G. Brune, S. M. Schoberth, and H. Sahm.
Process Biochemistry, Vol 17, No 3, p 20-22,24,35, May/June, 1982. 11 Fig, 3 Tab, 25 Ref.

Descriptors: *Anaerobic digestion, *Acids, *Sulfite liquors, *Wastewater treatment, Industrial wastewater, Acetic acid, Furfural.

Acid wastewater from a cellulose factory was treated in a continuous anaerobic digester. Composition of the vapor condensate influent was: acetic acid, 6-24 g per liter; furfural, 0.5-3 g per liter; sulfur, as sulfurous and sulfuric acids, 0.64-1.28 g per liter; COD, 10,000-20,000 mg 02 per liter; and pH, 1.6-1.7. An 85% reduction in COD and stable methane production rates were achieved at both 37 and 60C. In the start-up procedure the digesters were run as pH auxostats, where the activity of the bacteria governed the feed rate. Stable methane production of 0.35-0.4 cu m per kg COD consumed was achieved after 12-14 weeks. The retention time of 12 days (37C) and 14 days (60C) was decreased to 3-4 days by recycling the biomass by external sedimentation or by filtration. (Cassar-FRC)
W83-00587

SLUDGE INCINERATION WITH ENERGY RECOVERY,
For primary bibliographic entry see Field 5E.
W83-00608

WAYBILL SYSTEM IS A KEY TO INDUSTRIAL WASTE MANAGEMENT AND DISPOSAL,
For primary bibliographic entry see Field 5G.
W83-00611

SITE EVALUATION, DESIGN, OPERATION, AND INSTALLATION OF HOME SEWAGE SYSTEMS IN IOWA,
Iowa State Univ., Ames. Dept. of Agricultural Engineering.
C. E. Beer.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-125245, Price codes: A04 in paper copy, A01 in microfiche. Iowa State Water Resources Research Institute Report ISWRRI-93, Ames, June, 1982. 63 p, 67 Fig, 17 Tab, 47 Ref, 1 Append. OWRT A-064-IA(1), 14-34-0001-7034.

Descriptors: *Wastewater treatment, *Waste disposal, *Sewer systems, *Wastewater facilities, *Design criteria, *Iowa, Groundwater quality, On-site investigations, Sewers, Sorption, Effluents, Waste load, Wastewater disposal, Wastewater pollution, Absorption, Field wastes, Percolation rate, Construction methods.

Investigations were carried out to develop information for solving problems associated with the design, location, and maintenance of on-site waste treatment systems for dwellings. Three specific activities were undertaken. One focused on the development of information concerning the origin, description, and classification of soils, and on how the soil properties/characteristics related to proper site evaluation for optimum waste treatment. A second activity examined Iowa groundwater districts and assessed the geology and location of the water resources relative to potential pollution hazards associated with waste treatment systems. A third study area developed guidance for selecting design criteria and construction methods for on-site waste treatment systems. The research findings and an extensive literature review are combined to provide information on both conventional and alternative systems for sanitarians, extension personnel, and contractors for on-site waste treatment systems. Research has shown that the adsorption field life can be lengthened if the entire absorption area receives effluent simultaneously. It is recommended that a dosed-alternating field can be used in soils having a percolation rate of 60-120 minutes/inch at proper design intake rates. (Zielinski-MAXIMA)
W83-00621

DEVELOPMENT OF A COUNTYWIDE MODEL MANAGEMENT ORGANIZATION FOR WASTEWATER,
Iowa State Univ., Ames. Dept. of Agricultural Engineering.
C. E. Beer, and K. M. Mancl.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-125252, Price codes: A06 in paper copy, A01 in microfiche. Iowa State Water Resources Research Institute Report ISWRRI-106, Iowa State University, Ames, July 1982. 101 p, 9 Fig, 3 Tab, 39 Ref, 3 Append. OWRT A-069-IA(1), 14-34-0001-9017.

Descriptors: *Wastewater management, *Sewer systems, *Surveys, *Septic wastewater, *Water analysis, Groundwater quality, Nitrates, *Wastewater treatment, Waste disposal, Wastewater facilities, Sewers, Sorption, Effluents, Waste load, Wastewater disposal, Wastewater pollution, Absorption, *Iowa, Water districts.

A model county ordinance to establish on-site wastewater management districts in Iowa counties was prepared, distributed to all 99 counties, and adopted by Guthrie County, creating a management district at Lake Panorama. Based on the acceptance, accomplishments, and few difficulties experienced at Lake Panorama, public management of on-site wastewater treatment systems is a workable, realistic alternative for rural Iowa. The problems encountered by the district and how they are handled have been presented and analyzed. High density use of on-site wastewater treatment systems in a rural subdivision in Polk County was also examined. Septic systems were investigated for evidence of failure, house-to-house surveys were performed, and well-water samples were analyzed. It was concluded that septic systems can operate satisfactorily for over 20 years. Only one of 68 well-water samples contained fecal coliform bacteria. Bacteria can be effectively removed through subsurface disposal of effluent even in a sandy loam to loamy sand under very high density development. Groundwater contamination by nitrate through subsurface disposal can, however, present a problem. Thirty-six samples exceeded the nitrate standard with the highest being 25.6 mg/liter nitrogen. (Zielinski-MAXIMA)
W83-00622

EVALUATION OF THE PERFORMANCE OF A COMBINED SEWER OVERFLOW RETENTION TANK,
Ontario Ministry of the Environment, Toronto.
W. Wong, and G. Zukovs.
Research Publication No 90, July 1982. 48 p, 10 Fig, 6 Tab, 6 Ref. 2 Append.

Descriptors: *Combined sewer overflows, *Holding tanks, *Water quality control, *Wastewater management, *Storm runoff, *Municipal wastewater, Overflow, Overflow channels, Storage tanks, Water tanks, Water storage, Waste disposal, Waste storage, *Toronto, Wastewater treatment, Evaluation, Wastewater collection, Storm sewers, Urban runoff, Ontario.

The performance of a combined sewer overflow tank in urban Toronto (capacity, 1.63 million Imperial gallons (IMG) was studied during the summers of 1977 and 1978 (covering 276 study days) during which 50 storms occurred. Thirty-three storm events produced inflow to the tank, of which 17 were wholly retained by the tank and the remainder represented a total 102.3 IMG overflow to Black Creek. Use of the tank reduced the overflow volume by 18%, and reduced pollutant loadings for BOD, solids, and nutrients (nitrogen and phosphorus) by an average of 38-47% of the total influent loading. The tank was, hence, found to be an effective device for reducing pollution from combined sewer overflow. The tank outlet barrier further removed essentially all floating material from the overflow to the Creek, greatly enhancing the aesthetic quality of the overflow. Coliform and enterococcus levels were measured for the tank inflow, but not at the tank outlet. Sediment accumulated in the tank after storms was generally 1-2 inches deep; larger solids were physically removed by shovel. The study results should benefit municipalities faced with controlling combined sewer

overflows, and aid the design and compliance monitoring of similar future facilities. (Zielinski-MAXIMA)
W83-00627

MODEL PROTOCOL FOR THE COMPREHENSIVE EVALUATION OF PUBLICLY OWNED TREATMENT WORKS PERFORMANCE AND OPERATION,
Gannett, Fleming, Corddry and Carpenter, Inc., Harrisburg, PA.
H. D. Roberts, A. C. Gray, Jr., P. E. Paul, and J. M. Houthoofd.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-180480, Price codes: A06 in paper copy, A01 in microfiche. Environmental Protection Agency Project Summary EPA-600/S2-82-015, May 1982. 3 p. 68-03-2571.

Descriptors: *Evaluation, *Municipal wastewater, *Wastewater treatment facilities, *Performance evaluation, Design criteria, Monitoring, Maintenance, Administration, Standards.

A large percentage of municipal wastewater treatment plants do not meet design expectations and are not in compliance with their National Pollution Discharge Elimination System permit standards. A systematic approach to conducting a comprehensive performance evaluation of municipal wastewater treatment plants was developed. The objective of the evaluation is to identify and rank the causes of poor plant performance. Five major problem areas are addressed: design, performance monitoring, operation, maintenance, and administration. By following this protocol, an evaluation team will be able to identify deficiencies in each of the five categories, weigh them with respect to adverse impact on plant performance, and rank them in order of severity of impact. The preparatory steps to be completed before the actual plant visit include: notification of treatment works personnel and municipal officials; estimation of time, labor, materials, and money required to conduct the evaluation; and formulation of the field sampling and analytical program. The evaluation protocol has been prepared as a user-oriented field document that provides specific guidance for conducting comprehensive plant evaluations and identifying problems and solutions to improve plant performance. (Moore-SRC)
W83-00631

PERFORMANCE OF TRICKLING FILTER PLANTS: RELIABILITY, STABILITY AND VARIABILITY,
California Univ., Davis.
R. Haugh, S. Niku, E. D. Schroeder, and G. Tchobanoglous.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-108143, Price codes: A06 in paper copy, A01 in microfiche. Environmental Protection Agency Project Summary EPA-600/S2-81-228, December 1981. 13 p, 3 Fig, 5 Tab. R805097-01.

Descriptors: *Trickling filters, *Wastewater treatment, *Effluents, *Biochemical oxygen demand, *Suspended solids, *Performance evaluation, Statistical analysis, Variability, Reliability, Regression analysis, Seasonal variation.

Effluent quality variability from trickling filters was examined in this study by statistically analyzing daily effluent BOD5 and suspended solids data from 11 treatment plants. Summary statistics (mean, standard deviation, etc.) were examined to determine the general characteristics of those data. Distributions of most effluent data were skewed to the right, and daily suspended solids data generally exhibited more variation than daily BOD5 data. Five probability distribution functions, chosen through experience and the literature, were tested to determine which would be best used to describe daily, 7-day average and 30-day average effluent data distributions. Three distributions (the two parameter empirical, the gamma, and the log normal) were found to be adequate, with the log normal being preferred because of the ease of application. Daily effluent BOD5 and suspended solids data were found to contain both random and nonrandom components. Weekly cycles are found in about half of the plants studied, and significant month-to-month variation in effluent quality was found in every plant. Effluent BOD and suspended solids concentrations were higher in winter than in summer when pooled data from all plants were examined. Multiple regression analysis was used to determine the effects of various process parameters on effluent quality. In general, primary effluent BOD5 and suspended solids concentrations and wastewater temperature had the greatest effect. Variation due to measurement error was estimated to be 5 to 78% and 11 to 78% for effluent BOD5 and suspended solids values, respectively. Methods for incorporating statistical concepts into trickling filter design and operation are discussed. (Author's abstract)
W83-00634

PILOT PLANT STUDY ON SEWAGE SLUDGE PYROLYSIS-I,
NGK Insulators Ltd., Nagoya (Japan).
For primary bibliographic entry see Field 5E.
W83-00647

COST-EFFECTIVE PROGRAM FOR COMBINED SEWER OVERFLOW ABATEMENT,
O'Brien and Gere Engineers Inc., Syracuse, NY.
For primary bibliographic entry see Field 5G.
W83-00659

STABILITY OF CHLORINE DIOXIDE IN AQUEOUS SOLUTION,
Barcelona Univ. (Spain).
M. Medir, and F. Giralt.
Water Research, Vol 16, No 9, p 1379-1382, September, 1982. 3 Fig, 10 Ref.

Descriptors: *Chlorine dioxide, *Kinetics, *Disinfection, Wastewater treatment, Decomposition, Oxidation.

Chloride dioxide (0.002-0.04 mol per liter) in unbuffered solutions at pH 9 and 25C decomposed to chlorate, chlorite, chloride, and oxygen in the proportions 5:3:1:0.75, respectively. These products were dissimilar to those formed by chlorine dioxide decomposition in strong alkaline medium in buffered solution: chlorate, chlorite, and hydrogen ion. Two reactions, an initial slow reaction and a subsequent fast reaction, were seen in the unbuffered solution. The initial rate of the slow reaction in water was pseudo first-order with a rate constant of 0.0003 per min, and in 0.65-0.9 mol per liter sodium sulfate solutions, 0.00087 per min. The length of the slow reaction period decreased with chlorine dioxide initial concentrations. At 0.00317 mol per liter chlorine dioxide, about 10% decomposed by 600 min and 80% by 1000 min. Addition of sodium chloride solutions (0.1-0.8 M) to 0.02-0.02 mol per liter chlorine dioxide reduced the stable period to a few minutes; 10% of chlorine dioxide decomposed within an hour and 70% within 400 min. Chloride ion also slowed down the second reaction and changed the product distribution to a 1:1 molar ratio, increasing the oxidizing potential of chlorine dioxide. In buffered solution at pH 8.8 the reaction was pseudo second-order, producing chlorate and chlorite. (Cassar-FRC)
W83-00667

THE EFFECT OF WATER HARDNESS ON NITRILOTRIACETATE REMOVAL AND MICROBIAL ACCLIMATION IN ACTIVATED SLUDGE,
Procter and Gamble Co., Cincinnati, OH.
R. D. Vashon, W. J. Jones, and A. G. Payne.
Water Research, Vol 16, No 9, p 1429-1432, September, 1982. 3 Tab, 29 Ref.

Descriptors: *Activated sludge process, *Nitrilotriacetic acid, *Hardness, *Wastewater treatment, Acclimatization, Biodegradation, Degradation, Biological treatment, Detergents.

Water hardness had little effect on nitrilotriacetic acid (NTA) removal in 4 laboratory-scale activated sludge reactors. After acclimatization > 90% NTA removal was observed. The times to reach 60% and 90% NTA removal were: hard water (250 mg per liter as CaC03, pH 7.4), 8 and 15 days, respectively; and soft water (50 mg per liter as CaC03, pH 6.4), 20 and 28 days, respectively. During the acclimatizing period NTA-utilizing bacteria increased 100-fold. The rate of increase of these bacteria was faster in hard water than in soft water and faster in semicontinuous reactors than in continuous reactors. Average ultimate biodegradation of NTA in the acclimatized units as measured by C14-labeled NTA was 89.9 + or - 4.7% in soft water and 86.2 + or - 4.7% in hard water. Less than 1% accumulated in the sludge. (Cassar-FRC)
W83-00668

STABILITY AND PERFORMANCE OF ANAEROBIC FIXED FILM REACTORS DURING HYDRAULIC OVERLOADING AT 10-35C,
National Research Council of Canada, Ottawa (Ontario). Div. of Biological Sciences.
K. J. Kennedy, and L. van den Berg.
Water Research, Vol 16, No 9, p 1391-1398, September, 1982. 8 Fig, 5 Tab, 16 Ref.

Descriptors: *Anaerobic digestion, *Hydraulic loading, *Shock loads, *Wastewater treatment, Performance evaluation, Temperature effects, Fixed film digesters.

Laboratory anaerobic fixed film reactors severly overloaded to 94 kg COD per cu m per day for 24 hours returned to normal performance within 12-48 hours after overloading. Three types of wastewater were used: bean blanching waste, chemical industry waste (mostly short chain volatile fatty acids and ammonia), and heat treated sewage digester sludge. Overloading decreased COD removal and increased volatile fatty acids concentrations, the amount of reduction depending on the temperature and type of waste. Methane production decreased soon after overloading, then increased slightly for the duration of the upset. After overloading, methane production increased dramatically to a new steady state and slowly returned to normal levels as the excess fatty acids were converted. The proportion of carbon dioxide in the digester gas was also increased during the overload. Overloading at operating temperatures of 10,25 and 35C showed that COD removal and methane production was less at the lower temperatures. The repeated overloads increased the loading capacity of the reactors by 5-10%. (Cassar-FRC)
W83-00670

DEVELOPMENT OF A SETTLING MODEL FOR PRIMARY SETTLING TANKS,
Singapore Univ. Dept. of Civil Engineering.
J.-H. Tay.
Water Research, Vol 16, No 9, p 1413-1417, September, 1982. 4 Fig, 3 Tab.

Descriptors: *Primary wastewater treatment, *Suspended solids, *Settling tanks, *Wastewater treatment, Model studies, *Ontario.

A settling model was developed from data on settling characteristics of wastewater suspensions and the hydraulic characteristics of the primary settling tanks at three Ontario wastewater treatment plants. Data was obtained from settling column tests, tracer studies, and removal efficiencies of suspended solids. Flow rates were variable, and ferric chloride and polymer were added on some occasions. Half-removal times (the time at which 50% of influent suspended solids is removed) were 3 and 9 times shorter for addition of ferric chloride and ferric chloride with polymer, respectively, than for no chemical addition. Data on suspended solids removal from other researchers agreed well with model predictions. (Cassar-FRC)
W83-00671

COMPARATIVE EVALUATION OF MATHEMATIC MODELS USED FOR CALCULATING AERATION TANKS,
V. A. Vavilin, and V. S. Vasil'ev.
Water Resources, Vol 8, No 4, p 420-431, July/August, 1981. 3 Fig, 8 Tab, 30 Ref. Translated

from Vodnye Resursy, No 4, p 132-145, July/August, 1981.

Descriptors: *Model studies, *Aeration tanks, Mathematical models, *Wastewater treatment, Activated sludge process, Oxidation, Biological treatment, Design criteria.

Twenty mathematical models for calculating aeration tanks for wastewater treatment processes, including four empirical models proposed by the authors, are compared. For single substance substrates biological oxidation is well described by the classical Monod type microbiological models, the limiting cases of which are reactions of zero and first order. For multicomponent waters, models using higher orders of reaction are more adequate, in particular, a model of a second-order reaction containing one constant. The oxidation rate constant in the mixer can be higher than in the displacer. For a multistage aeration tank the formal n-th order models can be inapplicable, designating that the volume of the stages of the tank should decrease in the direction of the flows. (Cassar-FRC)
W83-00672

USE OF A KINETIC STUDY TO OPTIMIZE THE ACTIVATED SLUDGE PROCESS,
Naval Facilities Engineering Command, Pearl Harbor, HI. Pacific Div.
P. R. Vasicek.
Journal of the Water Pollution Control Federation, Vol 54, No 8, p 1176-1184, August, 1982. 10 Fig, 1 Tab, 11 Ref.

Descriptors: *Activated sludge process, *Kinetics, *Shock loads, Wastewater treatment, Fort Kamehameha, Pearl Harbor, *Hawaii, Mathematical models, Model studies, Performance evaluation, Sludge, Oxygen uptake.

Activated sludge process parameters and wastewater quality parameters were studied in a 3-month experiment using effluent from a primary clarifer at Fort Kamehameha Treatment Works at Pearl Harbor, Hawaii. The food/microorganism ratio was varied up to 0.4 as BOD5. Kinetic design constants were determined using the steady-state mathematical models for substrate removal, sludge production, and oxygen utilization. The constants and their BOD5 and COD based values were listed. Constants were: substrate utilization rate constants, yield coefficients, and endogenous respiration rates. Application of the constants to the Ft. Kamehameha plant operation suggested process adjustments such as a change of plug flow wastewater input to a modified contact stabilization process and reduction of the food/microorganisms ratio and hydraulic retention time. These changes helped eliminate upsets from shock loads introduced into a normally weak-strength wastewater influent. (Cassar-FRC)
W83-00677

5E. Ultimate Disposal Of Wastes

HEALTH EFFECTS ASSOCIATED WITH WASTEWATER TREATMENT AND DISPOSAL,
Cincinnati, Ohio, Health Effects Research Lab., Cincinnati, OH.
For primary bibliographic entry see Field 5C.
W83-00371

UPRATING SLUDGE TREATMENT PROCESSES,
Water Resources Council Process Engineering, (England).
A. M. Bruce, and C. F. Lockyear.
Water Pollution Control, Vol 81, No 3, p 425-443, 1982. 9 Fig, 32 Ref.

Descriptors: *Sludge thickening, *Sludge digestion, *Dewatering, Reviews, Sludge solids, Sludge filters, Sludge cake, Sludge conditioning, Anaerobic digestion, Polyelectrolytes, Denitrification, Retention time, Mixing, Filtration, Filter rate.

Several processes for uprating the performance of sludge treatment woithout increasing the plant size or capacity are available. This paper discusses gravity thickening, anaerobic digestion, and mechanical dewatering. Gravity thickener performance may be improved by increasing the rate of thickening. Insufficient retention time may be corrected by polyelectrolyte addition or conversion to continuous operation. Excessive biological activity, resulting in sludge flotation, may be solved by addition of polyelectrolyte, installation of picket fences, denitrification of sludge by adding a carbon source, and stabilization of sludge by gamma irradiation or addition of lime, clay, or fly ash. Upgrading an anaerobic digester should first consider if any inhibitory substances are present in the raw sludge. Performance of unheated digesters can be improved by installing mixing and heating in winter. The mesophilic anaerobic plants may be made more efficient by increasing retention time, increasing the solids content up to 9-10%, sludge pre-thickening before digestion, optimizing heat exchange, providing supplemental heat in winter, and improving mixing. Dewatering processes involve filter pressing and belt pressing. In filter pressing the rate of filtration may be increased by thickening the feed sludge, reducing the sludge volume to be dewatered, installing rubber drainage surfaces to facilitate dislodging of trapped cake, and using membrane presses. The belt pressing process may be uprated by increasing sludge throughout. (Cassar-FRC)
W83-00462

VACUUM TECHNOLOGY AND ITS APPLICATION IN THE WATER INDUSTRY,
General Vacuum Services, West Midlands (England).
F. R. Furlong.
Water Services, Vol 86, No 1036, p 276, 279, June, 1982.

Descriptors: *Sludge disposal, *Pumping, Suck and blow system, Water industry, Sludge lagoons, Vacuum technology.

A vacuum system was designed to convey sludges and waste products from water and wastewater treatment. Known as the SB system (suck and blow), it produces a continuous high vacuum (28 in Hg) with a low air flow using pneumatically controlled and operated sensors to govern the length of time to complete each cycle. The equipment is capable of 30 m lifts and 500 m horizontal conveyance. Improvements being developed will improve performance through better handling of lighter materials and an intake device which breaks down solids prior to removal. The apparatus may also be developed for use in sewer cleaning. (Cassar-FRC)
W83-00468

ONSITE ALTERNATIVES FOR TREATMENT AND DISPOSAL,
Wisconsin Univ.-Madison.
For primary bibliographic entry see Field 5D.
W83-00482

SLUDGE TREATMENT, UTILIZATION, AND DISPOSAL,
Duke Univ. Durham, Dept. of Civil Engineering.
P. A. Vesilind.
Journal of the Water Pollution Control Federation (Literature Review Issue), Vol 54, No 6, p 631-637, June, 1982. 151 Ref.

Descriptors: *Sludge, *Sludge disposal, *Sludge utilization, *Literature review, Sludge drying, Sludge digestion, Sludge thickening, Rheology, Wastewater treatment, Wastewater management, Incineration, Waste disposal, Digestion, Biodegradation, Land disposal.

A literature review is presented concerning several aspects of sludge treatment, use, and disposal. A document on research needs in sludge management considers the lack of planning, various engineering concerns, and lack of adequate technology that causes treatment and disposal problems. Several papers recognized that sludge management was a regional problem solvable by a systems approach. Publications discussing sludge properties focused on sludge particle size and sludge rheological characteristics. Works covering thermal treatment and incineration were included. Sludge thickening was the subject of some innovative papers, including a discussion of the design of the sludge removal mechanism, a description of a fluxmeter used to determine automatically the movement of solids in a batch settling test, a comparison of thickening theories, and thickening models. Works on dewatering included a survey of fundamental principles, descriptions of dewatering practices in Europe, various aspects of centrifugal dewatering, problems and design of vacuum filters, the formation of filter cakes, and studies on the diaphragm filter press. Stabilization papers considered principles of sludge decomposition, pathways of sludge stabilization on land, anaerobic digestion, separate digestion of primary and secondary sludges, dual digestion, composting, the destruction of pathogens, and the problems of floating sludge and odor control. Several review articles on sludge disposal on land appeared. Other works on ultimate disposal and utilization covered the quality of leachates from different sludges, sludge transport, the movement of PCBs and chlorinated hydrocarbon pesticides in a treatment plant, the effects of heavy metals in sludge, and the effect of sludge application on the growth of various organisms. (Gish-FRC)
W83-00483

OPERATING EXPERIENCE WITH THERMOPHILIC ANAEROBIC DIGESTION,
Los Angeles Bureau of Sanitation, CA.
For primary bibliographic entry see Field 5D.
W83-00490

GROUND-WATER POLLUTION INVESTIGATIONS IN THE GREAT OUSE BASIN. II-SOLID WASTE DISPOSAL,
For primary bibliographic entry see Field 5B.
W83-00507

NEW SLUDGE SYSTEM REDUCES LAND-FILLING NEEDS AT WEYERHAEUSER.
For primary bibliographic entry see Field 5D.
W83-00586

SLUDGE INCINERATION WITH ENERGY RECOVERY,
J. H. Mulholland.
Water and Pollution Control, Vol 120, No 4, p 13-14, July/August, 1982. 1 Fig.

Descriptors: *Fluidized beds, *Incineration, *Sludge utilization, *Solid waste disposal, *Waste recovery, Fluidized bed process, Sludge disposal, Waste disposal, Recycling, Wastewater facilities, Wastewater treatment, Water pollution control, Toronto, *Ontario.

The Duffin Creek Water Pollution Control Plant Incineration Facility is thought to be the largest operational fluidized bed sewage sludge incineration/waste energy facility in the world. The plant will be expanded in four stages to have a capacity of 740,000 cu meters/day. The incinerator/boiler building includes incinerators, waste heat recovery boilers, auxilliary steam boilers for start-up and emergency use, plant process and building heating services, air pollution scrubbing system and stack. A steam turbine provides power to the combustion air blower which draws air from the adjacent dewatering building and compresses it to 40 kPa and then passes it through the heat exchanger where it is heated before entering the fluid bed. Dewatering sludge is fed into the sand bed where it ignites to keep the sand at 820 degrees. In addition to several energy saving aspects, the plant also features belt filter presses to mechanically dewater the sludge with more than an 80% reduction in electrical power requirements over conventional vacuum filter installations. The Stage I Capital Works incorporates design features for future energy recovery and conservation and can be expanded to accommodate 4 incinerator systems and two 2,000 kW steam turbine generators. (Geiger-FRC)
W83-00608

COMPOSTING SEWAGE SLUDGE BY MEANS OF FORCED AERATION,
L. S. Ramano.
Water and Pollution Control, Vol 120, No 4, p 26-28, July/August, 1982.

Descriptors: *Composting, *Sludge disposal, *Sludge utilization, *Landfills, Recycling, Solid waste disposal, Waste recovery, Aeration, Sludge drying, Sludge cake, Humus sludge, Windsor, Ontario.

The City of Windsor began to look for new ways of disposing of sewage sludge after the closing of its sanitary landfill sites in the summer of 1973. The static aerated rapid composting process that was developed by the United States Department of Agriculuture at its research laboratories in Beltsville, Maryland was evaluated using sludge produced in West Windsor. The trials proved the method to be satisfactory for composting using wood chips as the bulking agent. The compost will be used to convert a landfill on the city's west side to a park and a golf course. The West Windsor Pollution Control Plant was chosen for composting, and the compost was located on plant property. All leachate and runoff from the compost pile was channeled into a sanitary sewer. Temperature and oxygen levels are measured periodically in the curing piles, which are broken down after 30 days of composting. The compost is then screened to recover 80% of the original wood chips before being used in park redevelopment and right-of-way restoration. The cost to compost the sludge cake is slightly less than $11 per ton. The West Windsor compost will be used in trials on corn plots near Ridgetown, Ontario, as a source of humus. Compost helps prevent wind erosion of sandy soils, is good for quick grass growth, and is useful as a landfill material. While composting of sludge cake is labor-intensive, it may prove to be more economical in the long run than other sludge cake disposal methods. (Geiger-FRC)
W83-00614

LARGE SUBSURFACE SEWAGE DISPOSAL SYSTEMS,
For primary bibliographic entry see Field 5B.
W83-00626

PHYSICAL AND CHEMICAL CHARACTERISTICS OF SYNTHETIC ASPHALT PRODUCED FROM LIQUEFACTION OF SEWAGE SLUDGE,
Battelle Northwest, Richland, WA.
J. M. Donovan, R. K. Miller, T. R. Batter, and R. P. Lottman.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-119082, Price codes: A04 in paper copy, A01 in microfiche. Environmental Protection Agency Project Summary EPA-600/S2-81-242, December 1981. 7 p, 1 Fig, 4 Tab. R-806790-01.

Descriptors: *Sludge utilization, *Liquefaction, *Thermochemical processes, Cost analysis, Sludge disposal, Feasibility studies, Fuel, Wastewater treatment.

Alternative technologies for sewage sludge disposal need to be energy efficient and, if possible, some product of value should be recovered from sludge. Direct thermochemical liquefaction of primary undigested municipal sewage sludge was carried out to produce a low molecular weight steam-volatile oil, a high molecular weight synthetic asphalt, and a residual char cake. The latter product is capable of supplying the thermal energy requirements of the conversion process. The steam-volatile oil has immediate value as a synthetic fuel oil. The synthetic asphalt may prove to be a useful cement for paving with further research, or it can be used as a fuel or coking stock. It is outwardly similar to petroleum asphalt, but chemically different. The thermochemical liquefaction process should be capable of operating in a technically and environmentally acceptable manner in conjunction with many wastewater treatment facilities. The overall feasibility of the process depends on the value of the oil and synthetic asphalt products as petroleum replacements and on the costs associated with disposal of sludge. Projected economics indicate that the process has considerable promise for many potential sites in the United States at the present time. (Moore-SRC)
W83-00636

SURVEY OF ON-GOING AND COMPLETED REMEDIAL ACTION PROJECTS,
SCS Engineers, Covington, KY.
For primary bibliographic entry see Field 5G.
W83-00637

PILOT PLANT STUDY ON SEWAGE SLUDGE PYROLYSIS-I,
NGK Insulators Ltd., Nagoya (Japan).
T. Kasakura, and M. Hiraoka.
Water Research, Vol 16, No 8, p 1335-1348, August, 1982. 6 Fig, 12 Tab, 10 Ref.

Descriptors: *Sludge dewatering, *Pyrolysis, *Wastewater treatment, Incineration, Sludge disposal, Waste disposal, Activated sludge process, Pilot plants.

The performance of drying-pyrolysis process in pilot scale was evaluated and the efficiency of the operation as a thermal processing of sewage sludge was demonstrated. A comparison was made of the drying-pyrolysis process with other thermal processes of sewage sludge and the feasibility of the practical plant of drying-pyrolysis process was demonstrated. Pyrolysis is defined as thermal processing which decomposes the solids containing organic compounds into three parts: combustible pyrolytic gas and combustion gas; pyrolytic oil, organic acid and water; and residue containing char and ash, at the temperature ranging from 500 to 1000C. Waste water from such operations arises primarily from scrubbing operations which always serve as a pretreatment for cooling and dehumidifying of exhaust gas. Some portion of the pollutants transfer into the liquid phase. Characteristics of waste water vary with the type of scrubbing equipment and liquid to gas ratio. It is concluded that the pyrolysis process offers a solution for problems of secondary pollution in thermal processings and of large energy consumption. (Baker-FRC)
W83-00647

INTERLABORATORY TESTING OF THE LEACHABILITY OF WASTES AND SLUDGES (RINGVERSUCHE ZUR BESTIMMUNG DER ELUIERBARKEIT VON ABFALLEN UND SCHLAMMEN MIT WASSER),
For primary bibliographic entry see Field 5B.
W83-00650

EFFECT OF LIQUID WASTEWATER SLUDGE APPLICATION ON CROP YIELD AND WATER QUALITY,
Science and Education Administration, St. Paul, MN.
D. R. Duncomb, W. E. Larson, C. E. Clapp, R. H. Dowdy, and D. R. Linden.
Journal of the Water Pollution Control Federation, Vol 54, No 8, p 1185-1193, August, 1982. 1 Fig, 8 Tab, 10 Ref.

Descriptors: *Land disposal, *Crop yield, *Nutrients, Fate of pollutants, Corn, Grasses, Agriculture, Nitrates, Phosphates, Groundwater pollution, Trace metals, Water quality, *Minnesota.

Liquid digested wastewater sludge was applied to a 16 ha terraced experimental watershed at Rosemount Agricultural Experiment Station, Minnesota, during the years 1974-79. A total of 73.9 metric tons per ha were applied to an area cropped to corn, and 85.2 metric tons were applied to an area cropped to reed canary grass. Total amounts of nutrients were 4160, 2060, and 320 kg of N, P, and K, respectively, on corn and 4810, 2050, and 410 kg of N. P. and K, respectively, on the canarygrass. Mean corn grain yields (1976-79) were 10.4 metric tons per ha; grass yields were 10.9 metric tons per ha. Of the applied N, 26% and 34% were removed by the corn and grass, respectively in 1976-79. Nitrate concentrations in soil water at the 150 cm depth were 61-262 mg per liter under corn areas and 20-69 mg per liter under grass. The differences in nitrate levels between the 2 crop areas were associated with the higher N demands of reed canarygrass. No significant increases in phosphate or trace metals levels were detected in plant tissue or soil water at any depth with any treatment. (Cassar-FRC)
W83-00656

BENTHAL STABILIZATION OF WASTE ACTIVATED SLUDGE,
Clemson Univ., SC. Dept. of Environmental Systems Engineering.
L. G. Rich, and B. W. Connor.
Water Research, Vol 16, No 9, p 1419-1423, September, 1982. 4 Fig, 3 Tab, 18 Ref.

Descriptors: *Sludge digestion, *Stabilization lagoons, Activated sludge, Anaerobic digestion, Sludge solids, Benthal stabilization, Digestion, Methane.

Benthal stabilization of waste activated sludge solids was studied for 42 weeks in a 10 ft tall, 8 in diameter laboratory column. Sludge suspensions were added to the top of the water-filled column twice a week. Average loading rate was 56.8 g per sq m per day of solids. After the solid material settled to the bottom, the overlying water was aerated. The system was stable and odor-free as long as dissolved oxygen was maintained in the water column. An average benthal stabilization rate (in terms of biodegradable solids) of 79.4 g per sq m per day was attained at temperatures of 20 + or - 1C and if solids were not limiting. Components of the stabilization rate (in g per sq m per day) were 49.8 for methane production, 18.7 for direct oxygen uptake, and 10.9 for BOD 5 release. The sludge remaining in the column after the study period contained 2.3% solids. (Cassar-FRC)
W83-00679

SEWAGE PLUME IN A SAND AND GRAVEL AQUIFER, CAPE COD, MASSACHUSETTS,
Geological Survey, Boston, MA. Water Resources Div.
For primary bibliographic entry see Field 5B.
W83-00688

REGIONAL GEOHYDROLOGY OF THE NORTHERN LOUISIAN SALT-DOME BASIN, PART I, CONCEPTUAL MODEL AND DATA NEEDS,
Geological Survey, Baton Rouge, LA. Water Resources Div.
For primary bibliographic entry see Field 2F.
W83-00691

5F. Water Treatment and Quality Alteration

NEW DEQ WATER POLICY MORE RECEPTIVE TO CITY NEEDS,
League of Iowa Municipalities, Des Moines.
L. W. Elliott.
Current Municipal Problems, Vol 7, No 2, p 240-243, 1980.

Descriptors: *Metropolitan water management, *Water policy, Water management, Planning, Water demand, Public policy, *Iowa, State jurisdiction, Legal aspects, Urban areas, *Water quality standards.

In an effort to more realistically deal with compliance problems facing many Iowa cities, the Department of Environmental Quality's (DEQ) Water Quality Commission recently approved a policy that will use executive order procedures as outlined in the Iowa Code. The policy calls for the use of both compliance letters and executive order. Compliance letters will be used for two purposes. First, in cases where a city's water supply does not meet standards for one or more contaminants, but the health hazard is minimal, the city will receive a compliance letter. In some cases a continuation of monitoring and public notification will be recom-

mended. The second purpose for a compliance letter would be in cases where DEQ needs more data to confirm a suspected violation that must eventually be corrected, suchas a city having high radium levels showing up in the water samples. Once a problem has been documented, DEQ will issue an executive order outlining what violation has occurred and how the city must proceed. Neither a compliance letter nor an executive order will take effect until at least 30 days after the city receives it. (Baker-FRC)
W83-00423

DAILY INTAKE OF LEAD, CADMIUM, COPPER, AND ZINC FROM DRINKING WATER: THE SEATTLE STUDY OF TRACE METAL EXPOSURE,
National Heart, Lung, and Blood Inst., Bethesda, MD. Epidemiology and Biometry Program.
For primary bibliographic entry see Field 5B.
W83-00431

COMPONENTS OF VARIATION IN LEAD, CADMIUM, COPPER, AND ZINC CONCENTRATION IN HOME DRINKING WATER: THE SEATTLE STUDY OF TRACE METAL EXPOSURE,
National Heart, Lung, and Blood Inst., Bethesda, MD. Epidemiology and Biometry Program.
For primary bibliographic entry see Field 5A.
W83-00432

DESTRUCTION OF POLLUTANTS IN WATER WITH OZONE IN COMBINATION WITH ULTRAVIOLET RADIATION. 2. NATURAL TRIHALOMETHANE PRECURSORS,
North Texas State Univ., Denton. Dept. of Chemistry.
W. H. Glaze, G. R. Peyton, S. Lin, R. Y. Huang, and J. L. Burleson.
Environmental Science and Technology, Vol 16, No 8, p 454-458, August, 1982. 9 Fig, 25 Ref.

Descriptors: *Ozonation, *Ultraviolet radiation, *Chlorinated hydrocarbons, *Water treatment, Ozone, Organic compounds, Kinetics, Activated carbon, Mass transfer, *Trihalomethanes, Caddo Lake, *Texas-Louisiana, Cross Lake, *Louisiana, *Oxidation.

Ozone-ultraviolet (03-UV) oxidation was more effective than ozone in destruction of trihalomethane (THM) precursors in water from Caddo Lake, Texas-Louisiana, and Cross Lake, Louisiana. Water from both lakes is characterized by low alkalinity and high levels of dissolved organic matter. Kinetic data suggested that secondary precursors of greater refractivity (probably 2 and 3 carbon polyfunctional organic acids) were formed by oxidation of the original organic compounds. These were resistant to oxidation with ozone alone but were more readily destroyed with the 03-UV process. For communities using water with high THM precursor levels, 03-UV is a viable treatment process either in place of or combined with activated carbon. (Cassar-FRC)
W83-00445

DESTRUCTION OF POLLUTANTS IN WATER WITH OZONE IN COMBINATION WITH ULTRAVIOLET RADIATION. 1. GENERAL PRINCIPLES AND OXIDATION OF TETRACHLOROETHYLENE,
North Texas State Univ., Denton. Dept. of Chemistry.
G. R. Peyton, F. Y. Huang, J. L. Burleson, and W. H. Glaze.
Environmental Science and Technology, Vol 16, No 8, p 448-453, August, 1982. 7 Fig, 4 Tab, 30 Ref.

Descriptors: *Chlorinated hydrocarbons, *Ozone, *Ultraviolet radiation, *Tetrachloroethylene, Organic compounds, *Oxidation, Ozonation, Water treatment, Kinetics, Photolysis, Mass transfer, Hydrocarbons.

A laboratory scale investigation of the ozone-ultraviolet (03-UV) process for oxidation of organic micropollutants in water studied ozone mass transfer, the kinetics of the 03-UV process, and the behavior of a typical substrate, tetrachloroethylene (TCE). The rate of substrate decay was represented as a linear combination of terms from the 4 contributing processes: purging, photolysis, ozonation, and photolytic oxidation (03-UV). Photo lytic oxidation of TCE was generally first-order. Using a continuously sparged stirred tank reactor, the times for elimination of 63% of the TCE substrate (initial concentration, 100 micrograms per liter) were determined for radiation doses of 0 to 0.375 W/L and ozone transfer rates of 0 to 0.78 mg per liter in both purified water and lake water. The 63% elimination times in purified water were 81 min for no radiation and no ozone (nitrogen purging), 4.4 min for the highest radiation dose and no ozone, 12.5 min for no radiation and the highest ozone rate, and 0.47 min for the highest radiation and highest ozone doses. Comparable values for lake water were 100, 20, 26, and 7 min, respectively. In the 03-UV process, elimination of 95% of TCE was 53 min at pH 4 and 395 min at pH 10. (Cassar-FRC)
W83-00446

INFLUENCE OF BROMIDE AND AMMONIA UPON THE FORMATION OF TRIHALOMETHANES UNDER WATER-TREATMENT CONDITIONS,
Imperial College of Science and Technology, London (England).
T. V. Luong, C. J. Peters, and R. Perry.
Environmental Science and Technology, Vol 16, No 8, p 473-479, August, 1982. 5 Fig, 4 Tab, 11 Ref.

Descriptors: *Chlorination, *Trihalomethanes, *Water treatment, *Chlorinated hydrocarbons, Organic matter, Fate of pollutants, Chemical reactions, Bromides, Ammonia.

The effects of low levels of bromide and ammonia on trihalomethane (THM) formation during water chlorination were studied. Chlorine doses were 2 and 8 mg per liter; total organic carbon (TOC) levels, 2.5 and 12.7 mg per liter; and bromide additions, 0-2000 micrograms per liter. THM distribution was dependent on the bromide concentrations at both high and low TOC levels. As bromide concentration increased, chloroform yield decreased, and bromoform concentration increased. At low TOC and high Br levels, bromoform was the major species present, accounting for 75% of the overall THM yield. Changing the Cl dose did not change the THM distribution. At the higher TOC level THM distribution was shifted toward the more chlorinated compounds, except when Cl dose was limiting. The minimum concentration of total THM was achieved at maximum pH and Br concentrations. Changes in pH during treatment had little effect on dissolved brominated THM because the dissolved component was over 90% of the total brominated THM present. The addition of 0.5 mg per liter ammonia to systems with 500 micrograms per liter Br reduced THM production by 30% for conventional breakpoint and by 50% for stepwise breakpoint chlorination. Overall THM yields for chloramination reactions were 38-46 micrograms per mg, compared with 63 micrograms per mg for ammonia-free reactions. (Cassar-FRC)
W83-00447

EVALUATING THE POTENTIAL FOR CONTAMINATING DRINKING WATER FROM THE CORROSION OF TIN-ANTIMONY SOLDER,
Herrera Environmental Consultants, Seattle, WA.
For primary bibliographic entry see Field 5B.
W83-00452

DETERMINING FREE AVAILABLE CHLORINE BY DPD-COLORIMETRIC, DPD-STEADIFAC (COLORIMETRIC), AND FACTS PROCEDURES,
Florida International Univ., Miami.
For primary bibliographic entry see Field 5A.
W83-00453

DISINFECTION.
Journal of the American Water Works Association, Vol 74, No 7, p 10, 376-380, July, 1982. 41 Ref.

Descriptors: *Disinfection, *Drinking water, *Public health, Chlorine, Ozone, Chloramines, Coliforms, Bacteria, Reviews, Potable water, Water treatment, Water quality.

The epidemiological rationale for disinfection is reviewed, along with a discussion of the significance of indicator organisms, and the use of ozone, chlorine, chloramines, and chlorine dioxide together with their toxicological impact on a finished water. The use of a disinfection process can accomplish the goal of a pathogen-free water supply more effectively than any other water treatment process. Most of the controversy centers around the selection of the optimum disinfection process and the requisite monitoring techniques. Much emphasis is currently being placed on the elimination of halogenated organic including trihalomethanes from potable waters. While chlorine will probably remain the treatment of choice for the near future, its use in many treatment facilities will be subject to change regarding dosages, points of application or monitoring requirements. Ozone and chlorine dioxide have distinct advantages for certain treatment applications. Chloramines historically have been important as disinfectants in many water utilities, and widespread use of these chemicals will continue. While the coliform test has served the industry well for many years, there is increasing evidence that coliforms are less resistant to chemical disinfectants than other pathogens. (Baker-FRC)
W83-00466

WATER ENGINEERING RESEARCH AT SWINDON.
Water Services, Vol 86, No 1036, p 284-286, June, 1982.

Descriptors: *Research priorities, *Laboratories, Swindon, *England, Water mains, Underground structures, Rehabilitation, Control systems, Automation, Water treatment, Wastewater treatment.

Swindon is the site of the Water Research Center's latest research facility, where investigations on undergound engineering and instrumentation control and automation are conducted. The center contains laboratories and a computer room linked to the other research centers at Stevenage and Medmenham. Among the projects under study are cleaning and rehabilitation of water mains, leakage detection and control, sewer inspection and renovation, materials engineering, and instrumentation control and automation. (Cassar-FRC)
W83-00469

SWIMMING POOL WATER TREATMENT IN THE UK,
Department of the Environment, London (England), Water Research Directorate.
O. D. Hydes, and I. C. Warren.
Water Services, Vol 86, No 1036, p 265-266, June, 1982. 1 Tab, 17 Ref.

Descriptors: *Disinfection, *Chlorination, *Swimming pools, Reviews, *Water treatment, Hypochlorites, Bromine, Ozone, *United Kingdom.

Publications on swimming pool water treatment in the United Kingdom are reviewed. The Department of Environment recommended that use of Cl gas for this purpose should cease by January 1985 and that alternative disinfectants should be substituted. A table lists disinfectants and recommended residuals, pH, and dosage and control methods. The disinfectants listed are sodium hypochlorite, calcium hypochlorite, electrolytically generated hypochlorite, bromine, 1,3-bromochloro-5,5-dimethylhydantoin, sodium dichloroisocyanurate, trichloroisocyanuric acid, and ozone with residual chlorination. (Cassar-FRC)
W83-00470

DISINFECTION,

Illinois Inst. of Tech., Chicago. Pritzker Dept. of Environmental Engineering.
C. N. Haas, and J. J. McCreary.
Journal of the Water Pollution Control Federation (Literature Review Issue), Vol 54, No 6, p 646-654, June, 1982. 136 Ref.

Descriptors: *Disinfection, *Chlorination, *Water treatment, *Literature review, Chlorine, Residual chlorine, Halogens, Ozone, *Wastewater treatment, Potable water, Inorganic compounds, Organic compounds, Trihalomethanes chemical reactions, Seawater.

Publications concerning five major aspects of disinfection are reviewed. Works on microbiology covered the chlorination of potable water and wastewater with regard to optimization, mixing, and dosage; the interrelationship between chemical measurements of chlorine and biological responses; a mathematical model for wastewater chlorination; the dechlorination of wastewater; the use of ozone, chlorine dioxide, bromine chloride, ultraviolet radiation, silver, and a solid resin with quaternary amine functional groups as disinfectants; and side-by-side comparisons of alternative disinfectants. The second category of publications concerned analytical methods, including procedures for determining free chlorine, residual chlorine in sea water, residual ozone in water, excess NC13, chlorine dioxide in water, and chlorite ion. Studies of inorganic transformations included the persistence or rate of disappearance of chlorine residuals, the reactions of chlorine with sea water, and methods for generating chlorine dioxide. The formation of nonvolatile organic compounds was investigated in spent chlorination liquor from the bleaching of kraft pulp; the phenomenon of chlorination which significantly modified the distribution of polynuclear aromatic hydrocarbon; analysis of products of C102 reactions with 22 volatile compounds; and the use of group parameters to characterize organochlorine compounds. Works concerning the formation of trihalomethanes were also included. (Gish-FRC)
W83-00487

EPA AND WATER SUPPLY--PRESENT AND FUTURE,
Environmental Protection Agency, Boston, MA.
For primary bibliographic entry see Field 5G.
W83-00493

EMERGENCY RESPONSE: A CASE FOR RISK DETERMINATION,
Maine Dept. of Human Service, Augusta.
W. C. Toppan.
Journal of the New England Water Works Association, Vol 96, No 2, p 151-160, 1982. 2 Fig.

Descriptors: *Risks, *Safety, *Toxicity, Emergencies, Carcinogens, Water supply, Maine, Organic compounds, Water pollution effects, Dose response curves.

A history is presented of Maine's Drinking Water Program and risk determination in emergency response planning. The acceptable daily intake (ADI) approach is a value reflecting a combination of knowledge and uncertainty about the relative safety of a chemical. It is a daily dose which is not likely to produce a toxic response in man. However, statistically valid conclusions are not easy to obtain because of the small size of studies and the uncertainty in extrapolating from animals to humans and from high doses to low doses. The risk estimate approach produces an acceptable level of exposure to a chemical. It is based on extrapolation of experimental dose-effect curves to lower dose levels, for which no data exists. The Suggested No Adverse Response Level (SNARL) method was developed for use in water supply. This is a formula considering the observed effect level (obtained from laboratory studies), factors relating laboratory animals to humans and children to adults, absorption factors, and an uncertainty factor. Recent publications have stated that animal toxicity test results may be extrapolated to man, that there is no threshold dose for long-term exposure, that no safe dose exists, that every dose has some risk, and that the most probable risk of a chemical can be estimated by comparing the benefits and risks. (Cassar-FRC)
W83-00494

MAINS INFESTATION CONTROL USING PERMETHRIN,
Severn-Trent Water Authority (England).
R. F. Crowther, and P. B. Smith.
Journal of the Institution of Water Engineers and Scientists, Vol 36, No 3, p 205-213, May, 1982. 1 Fig, 6 Tab, 1 Ref.

Descriptors: *Water distribution, *Aquatic animals, *Insecticides, Water treatment, Water mains, Asellus, Gammarus, *Permethrin, Isopods, Amphipods, Invertebrates.

An extensive infestation of Asellus and Gammarus in the water distribution system of the city of Derby, England, was controlled by flushing the system with 2% permethrin solution in April 1980. The treatment involved dechlorination of the system with sodium thiosulfate followed by two 7-day periods of permethrin injection. Water samples taken at the sewage works 4 days after the start of dosing showed no detectable permethrin. No effects on digester performance were seen. Mean levels of permethrin (micrograms per liter) in the system were: initial, 11.4; during dosing, 5.3; 2 days after dosing, 5.6; 3 days after dosing, 0.37, and 39 days after dosing, < 0.01. The fauna were absent from water samples taken several months later in September (except for one of 8 sections of the system). (Cassar-FRC)
W83-00498

DESIGN AND CONSTRUCTION OF THE PENNICHUCK WATER TREATMENT PLANT: THE EQUIPMENT SUPPLIER'S VIEW,
Infilco Degremont Inc., Richmond, VA.
C. H. Thorborg.
Journal of the New England Water Works Association, Vol 96, No 2, p 88-96, 1982. 6 Fig.

Descriptors: *Clarifiers, *Filtration, *Water treatment facilities, Water treatment, Pulsator clarifier, Pennichuck Water Works, Nashua, New Hampshire, Turbidity.

Equipment for the Pennichuck Water Works was chosen to handle the characteristics of the raw water, which were soft, low in total dissolved solids and alkalinity, 1-5 NTU turbidity, 20-30 color units, cold winter water temperatures, and significant organic content. The treatment included clarification with chemical addition and filtration, followed by chlorination. The Pulsator, an upflow sludge blanket clarifier, was the choice for the clarification step. Its basic parts were: vacuum chamber, vacuum blower (the mechanical heart), raw water distribution, treated water collection, sludge hoppers, and tank. Design flow is 20 mgd (using two 10 mgd Pulsators) with a hydraulic limit of 30 mgd. Six double bay Aquazur filters with a common clarified water/filter feed channel and a 1 million gal treated water clear well complete the basic design. Chemical feed and control are automated. (Cassar-FRC)
W83-00501

DESIGN AND CONSTRUCTION OF THE PENNICHUCK WATER TREATMENT PLANT: THE OWNER'S VIEW,
Pennichuck Water Works, Nashua, NH.
J. C. Collins.
Journal of the New England Water Works Association, Vol 96, No 2, p 84-87, 1982.

Descriptors: *Construction, *Planning, *Water treatment facilities, Financing, Pennichuck Water Works, Nashua, *New Hampshire, Design criteria, Water treatment, Economic aspects.

Initial planning for the 20 mgd Pennichuck Water Works, Nashua, New Hampshire, began in 1974, spurred by the gradual deterioration of the raw water supply and population growth. In spite of delays and the necessity to double the rate base of $7 million, the plant went on-line July 31, 1980, 5 months ahead of schedule and $400,000 below contract construction costs. The success of the project was attributed to good planning, flexibility in management, good construction planning and management, and effective team work. Financing for this investor-owned company was through municipal industrial revenue bonds, a preferred stock offering, a $7 million unsecured construction loan, and a rate increase. (Cassar-FRC)
W83-00502

COLOUR AND TURBIDITY REMOVAL WITH REUSABLE MAGNETIC PARTICLES-III IMMOBILIZED METAL HYDROXIDE GELS,
Commonwealth Scientific and Industrial Research Organization, Melbourne (Australia).
N. J. Anderson, L. O. Kolarik, E. A. Swinton, and D. E. Weiss.
Water Research, Vol 16, No 8, p 1327-1334, August, 1982. 7 Fig, 11 Ref.

Descriptors: *Turbidity, *Water treatment, *Clarification, Color removal, Water quality, Coagulation, Chemical coagulation, Adsorbents.

The preparation and use of a magnetic coagulant-adsorbent for removing color and turbidity from surface water is described. The adsorbent was made by deposition of ferric hydroxide gel onto fine magnetite. The surface charge of such a composite particle is pH dependent, and the amphoteric properties of the ferric hydroxide gel coating can be exploited in the clarification process. At pH less than 6, the surface is positively charged and adsorption of negatively charged particles occurs. Conversely, the adsorbed impurities can be released by increasing the pH to above pH 10. The reactivated particles can then be reused. The particles have high sedimentation rates and are easy to handle magnetically. The magnetic gel was successfully employed to treat a number of waters. It was especially effective in treating a highly colored reservoir water. It was possible to reuse the gel after regeneration for many cycles with a gradual deterioration in performance. (Baker-FRC)
W83-00506

ORGANIC AND ORGANOTIN COMPOUNDS LEACHED FROM PVC AND CPVC PIPE,
Michigan Univ., Ann Arbor. School of Public Health.
E. A. Boettner, G. L. Ball, Z. Hollingsworth, and R. Aquino.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-108333, Price codes: A06 in paper copy, A01 in microfiche. Environmental Protection Agency Project Summary EPA-600/S1-81-062, February 1982. 10 p, 2 Fig, 2 Tab.

Descriptors: *Organics solvents, *Organotin compounds, *Plastic pipes, *Leaching, *Water pollution sources, *Polyvinyl chloride, *Chlorinated polyvinyl chloride, Potable water, Sealants, Water supply, Chemical analysis, Tin, Dimethyltin, Dibutyltin, Methyl ethyl ketone, Tetrahydrofuran, Cyclohexanone.

Use of polyvinyl chloride (PVC) and chlorinated polyvinyl chloride (CPVC) pipe for potable water raises the question of whether chemicals of a toxic nature diffuse from the pipe into the water supply, and if so, in what quantities. Commercial pipe samples stabilized with dialkyltin-bis-isooctylthioglycolate compounds were tested for leaching. Alkyltin species were extractable from PVC and CPVC pipes by water. The amount of dimethyltin (as the dichloride) leached from PVC into pH 5 extractant water at 37C was 35 ppb for day one, and decreased from approximately 3.0 to 0.25 ppb in a biphasic manner from days 2 through 22. The amount of dibutyltin (as the dichloride) leached from CPVC into pH 5 extractant water at 72C was 2.6 ppb for day one, and decreased from 1.0 to 0.03 ppb in a biphasic manner from days 2 through 21. Volatile organic solvents (including methyl ethyl ketone, tetrahydrofuran, and cyclohexanone) used in the sealing cements applied to PVC and CPVC pipe joints continued to leach into water supplies for more than 14 days using a miniature pipe system. The quantities ranged from 10 ppm to 10 ppb during the 15 days of sampling. Sufficient

toxicological data are not available to assess the health significance of the very low levels of organotin and cement solvent chemicals found in this study. (Moore-SRC)
W83-00633

MICROBIOLOGY OF POTABLE WATER AND GROUND WATER,
Environmental Protection Agency, Dallas, TX. Region VI.
M. J. Allen.
Journal of the Water Pollution Control Federation (Literature Review Issue), Vol 54, No 6, p 943-946, June, 1982. 41 Ref.

Descriptors: *Literature reviews, *Microbiological studies, *Reviews, Drinking water, *Potable water, Water treatment, *Groundwater, Bacteria, Wastewater irrigation, Granular activated carbon, Carbon, Activated carbon, Disinfectants, Viruses, Microorganisms, Monitoring wells, Monitoring, Irrigation.

Recent research in the area of microbiology of potable water and groundwater is cited in this literature review. For potable water, increased use of the granular activated carbon and alternate disinfection practices to reduce trihalomethane formation has been studied. Also in the area of potable water, research has centered on heterotrophic bacterial populations that develop on GAC particles, on biocidal efficiencies of alternate drinking water disinfectants, on virus removal efficiencies during water treatment varying with type and dosage of coagulant, on changes in bacterial populations during a 19 month period, on types of particulates that can occur in tap water and stimulate microbial growth, and on viruses contained in municipal wading pools. In the area of groundwater research, the topics have included lysimeters and monitoring wells in areas irrigated with wastewater effluent. (Baker-FRC)
W83-00655

5G. Water Quality Control

PHOSPHORUS REDUCTION IN A MAN-MADE LAKE BY MEANS OF A SMALL RESERVOIR ON THE INFLOW,
Hydrualic Research Inst., Prague (Czechoslovakia).
L. Fiala, and P. Vasata.
Archiv fur Hydrobiologie, Vol 94, No 1, p 24-37, April, 1982. 8 Fig, 3 Tab, 11 Ref.

Descriptors: *Nutrient removal, *Phytoplankton, *Bacteria, Reservoirs, Jesenice Reservoir, *Czechoslovakia, Phosphorus, Nitrogen, Water quality control.

Phosphorus and nitrogen were reduced in a pre-reservoir formed by a railway embankment crossing the Jesenice Reservoir, Czechoslovakia. Inflowing water contained 400-600 micrograms per liter inorganic P, 500-800 micrograms per liter total P, and 5.5 mg per liter total N. Nutrient reductions at 5 or more days retention periods in summer were 90%, 65-70%, and 30-40%, respectively. Coliform bacteria were reduced from 100,000 per ml to about 1000 per ml. During summer stagnation phytoplankton blooms were seen in the pre-reservoir but not in the main body. Factors other than phytoplankton contributing to elimination of nutrients were probably chemical precipitation or sorption of P with Fe in the water and sediments. (Cassar-FRC)
W83-00396

URBAN RUNOFF CONTROL TECHNOLOGY,
Ontario Ministry of the Environment, Toronto.
For primary bibliographic entry see Field 5D.
W83-00416

ADJUDICATORY HEARINGS AS PART OF THE NPDES HEARING PROCESS,
Washington Univ., Seattle. Dept. of Civil Engineering.
For primary bibliographic entry see Field 6E.
W83-00424

EFFECT OF INDUSTRIAL-RESIDENTIAL ZONES ON WATER QUALITY OF SURFACE STREAMS,
For primary bibliographic entry see Field 5B.
W83-00460

EPA AND WATER SUPPLY--PRESENT AND FUTURE,
Environmental Protection Agency, Boston, MA.
L. A. Sutton.
Journal of the New England Water Works Association, Vol 96, No 2, p 135-139, 1982.

Descriptors: *Water supply, *Groundwater pollution, *Drinking water, *New England, Regulations, Water pollution sources, Public health.

New priorities of the EPA are described. These include a leaner budget, reorganization and streamlining, delegation of some responsibilities to the states, regulatory reform, improvement of the scientific base, placing environmental problems in a proper perspective, and improved public relations. The chief priority in the water supply program is provision of safe drinking water by using highest quality water sources and protecting these sources from degradation. Most New England surface water sources are relatively free of pollution by municipal and industrial wastewater discharges. Some threats to groundwater are storm water runoff (especially from road deicing salt), septic tank, leaching, leaking underground gasoline tanks, and illegal hazardous waste disposal. (Cassar-FRC)
W83-00493

THE USE OF HERBICIDES FOR AQUATIC WEED CONTROL IN WATER SUPPLY CATCHMENTS,
Severn-Trent Water Authority (England).
For primary bibliographic entry see Field 3B.
W83-00496

NATIONAL DRINKING WATER ADVISORY COUNCIL AND WATER UTILITY COUNCIL: WHAT DO THEY DO.,
Manchester Water Works, NH.
F. H. Elwell.
Journal of the New England Water Works Association, Vol 96, No 2, p 146-150, 1982.

Descriptors: *Legislation, *Water supply, *Utilities, Organizations, Regulations, Drinking water, Planning, National Drinking Water Advisory Council, Water Utility Council, Safe Drinking Water Act, American Water Works Association.

The National Drinking Water Advisory Council (NDWAC) and the Water Utility Council (WUC) have been established within the past ten years to advise on matters involving the provision of safe drinking water. The NDWAC consists of 15 members, 5 from each of the following: general public, state and local agencies concerned with public water supply, and private groups actively interested in public water supply. On the agenda are volatile organics and development of groundwater protection strategy. The WUC, the utility voice of the American Water Works Association, is concerned with legislation and regulatory matters affecting water utilities. The 20 WUC members form 4 permanent sub-committees: Small Water Systems, Large Water Systems, Regulatory Reform, and Legislation. A major item facing the Council is amendment of the Safe Drinking Water Act. The importance of communication with legislators by all those involved in water utilities is emphasized. (Cassar-FRC)
W83-00503

LIMNOLOGICAL RESEARCH CAN IMPROVE AND REDUCE THE COST OF MONITORING AND CONTROL OF WATER QUALITY,
Uppsala Univ. (Sweden). Inst. of Limnology.
C. Forsberg.
Hydrobiologia, Vol 86, No 1/2, p 143-146, January, 1982. 21 Ref.

Descriptors: *Sampling, *Monitoring, *Lake management, *Sweden, Water quality management, Pollutant identification, Limnology, Research priorities, Lakes, Rivers, Planning, Phosphorus, Water pollution effects.

Shortcomings in water quality control and monitoring programs in Sweden include: no central guidelines; great variations in sampling, analysis, and reporting techniques; no defined objectives; low-frequency sampling; limited flow data in running water studies; reporting of untreated primary data; and lack of studies to detect long-term changes. More reliable information at greater cost efficiency may be obtained by higher frequency sampling, especially in shallow lakes and small rivers; analysis of composite samples from strategically chosen stations; correlation analysis (for example, between summer average values and summer maximum values) to predict worst possible situations; and consideration of lake responses to nutrient loading. Further improvements can be realized with better information on relationships between structure and function of aquatic ecosystems and parameters such as form and size of water body, water flushing rate, and pollutant loads. (Cassar-FRC)
W83-00526

THE LIMNOLOGICAL BASIS FOR PLANNING WATER QUALITY MANAGEMENT,
Lund Univ. (Sweden). Limnological Inst.
I. Lundqvist.
Hydrobiologia, Vol 86, No 1/2, p 147-151, January, 1982. 3 Fig, 7 Ref.

Descriptors: Control, Recreation, *Sweden, Lakes, Limnology.

Planning for water conservancy (quality), water restoration, and water quality management must be based on an ecological approach. The ecological rules which consider both cultural and scientific nature conservancy planning should protect representative and unique water resources, water resources important to discrete species, water resources with esthetic values, and water resources of scientific importance. Guidelines for the restoration of damaged ecosystems should include assessment of the needs and conditions for restoration measures, considering the value of the lake to be restored and the needs for restoration work. A model for making water quality management decisions is presented. It consists of several stages: 1, integration of existing data; 2, identification of problems; 3, conflict analysis; 4, planning documents (identification of problems, problem solution, and consequence analysis); 5, decision making; 6, master plan; 7, implementation; and 8, post analysis. Examples of planning for water conservancy and lake restoration are given for several Swedish lakes. (Cassar-FRC)
W83-00527

WINTER MICROBIAL ACTIVITY IN LAKE TUUSULANJARVI,
Helsinki Water District (Finland).
T. Tamminen.
Hydrobiologia, Vol 86, No 1/2, p 109-113, January, 1982. 4 Fig, 2 Tab, 13 Ref.

Descriptors: *Heterotrophic bacteria, *Aeration, *Lake restoration, Eutrophic lakes, Lakes, Lake Tuusulanjarvi, *Finland, Primary productivity, Productivity, Dissolved oxygen, Oxygen, Seasonal variation, Nitrogen, Phosphorus, Fate of pollutants, Water pollution effects.

Microbial heterotrophic activity, dark carbon dioxide assimilation, primary productivity, and microbial ATP were determined from July 1979 to May 1979 in Lake Tuusulanjarvi, an extremely eutrophied lake. Pollution from the town of Jarvenpaa was ended in March 1979 after several decades of input. Nonpoint source pollution was also heavy. Aeration of the lake began in early autumn. This circulation prevented winter stratification. Nutrient concentrations were 1100-2300 micrograms per liter total N and 45-140 micrograms per liter total P. Glucose turnover times were 5-7 hours in summer, 10-20 hours from August to January (and in April) and 100-110 hours in February-March. Temperatures were about 1C from November to

April. Oxygen saturation reached a minimum of 46% compared with less than 25% during previous years when aeration was also carried out. Primary productivity was 10,000 mg C per sq m per day in summer, declining to 5000 mg C per sq m per day in November, and was measurable during the ten winter months. Dark C02 assimilation increased to 14% of primary productivity in March. (Cassar-FRC)
W83-00528

OIL SPILL CLEANUP FULFILLS AIM OF FEDERAL WATER POLLUTION CONTROL ACT,
M. Silver.
Natural Resources Journal, Vol 22, No 2, p 489-491, April, 1982. 12 Ref.

Descriptors: *Cleanup, *Legal aspects, *Oil spills, Cleanup operations, Water pollution control, Water pollution sources, Vandalism, Water quality standards.

On April 3, 1975 unknown vandals entered the yard of the Union Petroleum Corporation and discharged oil from two tank cars owned by and leased to third parties. Although seals were attached to valves on the tank cars loaded with oil, these valves were not locked and were susceptible to vandalism. The discharge amounted to about 600,000 gallons of fuel oil. Union promptly notified the Coast Guard, a cleanup contractor, the local police and fire departments and the state authorities. Union paid $99,952.17 in cleanup costs. In a subsequent suit the decision was made that those in charge of oil terminals who have taken reasonable precautions to prevent vandalism and oil spills into navigable rivers will be reimbursed when vandals spill oil from tank cars parked at the terminal. By awarding Union the full $99,952.17 encourages other terminal operators to quickly cleanup harmful discharges into the nation's waters. The court implicitly recognized that the general security practice in the industry is a reasonable standard of care. Though the standard tolerates some danger of discharge of harmful substances, this level of industry risk remains unchanged by the decision of the Court of Claims. (Baker-FRC)
W83-00566

NATIONAL ACID PRECIPITATION ASSESSMENT PLAN.
Report, Interagency Task Force on Acid Precipitation, 722 Jackson Place, N.W., Washington, D.C., 20006, June 1982. 92 p, 7 Fig, 1 Tab, 28 Ref. 3 Append.

Descriptors: *Research priorities, *Acid rain, *Air pollution, *Project planning, *Interagency cooperation, Rainfall, Fallout, Acidic water, Chemistry of precipitation, Legal aspects, Constitutional law, Optimum development plans, Alternative planning, Multiobjective planning, Management planning, Governmental interrelations.

The Acid Precipitation Act of 1980 established the Interagency Task Force on Acid Precipitation to develop and implement a comprehensive National Acid Precipitation Program. The developed plan for this program has five parts: a description of the authorizing legislation, the plan organization, and past and current acid rain research; a general overview of current understanding of the phenomena and consequences of acid rain; a discussion of information needed to enhance understanding of these phenomena and consequences; a description of proposed research to address the information needed; and a discussion of the general strategy for management and coordination of the overall program. Research is proposed in nine basic categories where more information concerning acid precipitation is needed. The described research tasks each focus on a specific area and generally involve the coordinated participation of several agencies and are categorized according to one of three priority levels. The Interagency Task Force is jointly chaired by the Department of Agriculture, EPA, and NOAA. Other participating agencies are: the Departments of Interior, Health and Human Services, Commerce, Energy, State; NASA; the Council of Environmental Quality; the National Science Foundation; and the Tennessee Valley Authority. (Zielinski-MAXIMA)
W83-00607

STEADY-STATE ECOSYSTEM MODELING FOR LAKE MANAGEMENT,
Maine Univ. at Orono. Land and Water Resources Center.
M. L. Hutchins, and P. D. Uttormark.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-125153, Price codes: A04 in paper copy, A01 in microfiche. Completion Report, July, 1982. 64 p, 13 Fig, 2 Tab, 46 Ref, 1 Append. OWRT B-018-ME(2).

Descriptors: *Ecosystems, *Model studies, *Long-tern planning, *Lake morphology, *Water management, Ecology, Mathematical models, Mathematical studies, Computer models, Fish populations, Plant populations, Algal growth, Algal control, Biomass, Aquatic productivity, Fish, Lake classification, Eutrophic lakes, Maine.

Two relatively simple models which appear useful for describing general ecosystem structure and interactions in the open-water zones of lakes are presented. These models are concerned with long-term steady-state conditions, rather than seasonal dynamics, and are used to examine how steady-state standing crops of the system components might be expected to change in response to a variety of system perturbations. Manipulative options showing potential for curbing undesirable eutrophication symptoms are particularly identified. The results indicate that lake ecosystem response to system partubations may be highly dependent on system structure. Minor system component/interaction changes may produce drastic system dynamics changes. It is shown that enhancing lake game fish populations may produce positive/negative effects on algal populations, depending on system structure/interactions, Further, two distinctly different steady-state lake ecosystems were found possible for a given nutrient supply rate. A predator-dominated system is viewed desirable, with low algal and high game fish biomasses even under phosphorus-rich conditions. A nutrient-limited system is less desirable, with high algal and low game fish biomasses. The ecological significance of two equilibria states is elaborated. (Zielinski-MAXIMA)
W83-00610

WAYBILL SYSTEM IS A KEY TO INDUSTRIAL WASTE MANAGEMENT AND DISPOSAL,
S. Davey.
Water and Pollution Control, Vol 120, No 4, p 19-20, July/August, 1982.

Descriptors: *Wastewater disposal, *Wastewater managment, *Industrial wastewater, *Water quality control, Industrial wastes, Wastewater treatment, Municipal wastewater, Liquid wastes, Waste management, Waste disposal, *Ontario, Niagara River.

There are 19 municipal and industrial sources of wastewater discharge into the Niagara River that meet Ontario standards or are currently under programs designed to meet these standards for river water quality control. However, problems of waste disposal on this river and in Lake Ontario into which it discharges are apparent in major pollution episodes at Love Canal and Hyde Park. The public expects government and industry to safeguard public health by disposing of harmful wastes in a proper manner. The Waybill system helps to meet these expectations by controlling the handling of liquid industrial wastes. New data processing and telecommunication systems will make waste handling and disposal records more accessible to regional enforcement agents. A special investigation unit of Environment Ontario has conducted 213 probes which resulted in 71 convictions in the past year. Waste management has been set as a priority program of the Environment Ontario Ministry. The Ontario Waste Management Corporation was established as a crown agency and plans three major technical projects. The first is an in-depth assessment of liquid industrial waste sources. The second deals with the various treatment and disposal techniques available. The third investigates possible sites for facilities while taking into account various social and environmental factors. The Corporation will also conduct a province-wide information program to keep the public informed of its works. (Geiger-FRC)
W83-00611

SURVEY OF ON-GOING AND COMPLETED REMEDIAL ACTION PROJECTS,
SCS Engineers, Covington, KY.
N. Neely, D. Gillespie, F. Schauf, and J. Walsh.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-134115, Price codes: A11 in paper copy, A01 in microfiche. Environmental Protection Agency Project Summary EPA-600/S2-81-246, January 1982. 4 p, 3 Tab. 68-01-4885.

Descriptors: *Hazardous materials, *Waste disposal, *Water pollution sources, *Groundwater pollution, *Water pollution control, Injection wells, Underground waste disposal, Land disposal, Waste dumps, Landfills, Incineration, Surface water.

During the summer of 1980, a nationwide survey was conducted to determine the status of remedial measures applied at uncontrolled hazardous waste disposal sites. Over 130 individuals were contacted to obtain information on remedial action projects. A total of 169 sites were subsequently identified as having had some kind of corrective measures. Remedial actions had been implemented at many kinds of hazardous waste disposal facilities including drum storage areas, incinerators, and injection wells, but most frequently at landfills/dumps and surface impoundments. At the sites receiving such remedial actions, groundwater was the most commonly affected media, followed closely by surface water. Although several types of technologies were identified, remedial activities usually consisted of containment and/or removal of the wastes. Sufficient money was often not available for complete environmental cleanup (e.g., groundwater extraction and treatment). A lack of sufficient funds and/or improper selection of corrective technologies were responsible for remedial actions having been applied effectively at only a portion of the uncontrolled hazardous waste disposal sites. Where applied, remedial actions were completely effective only 16% of the time. Nine sites were studied in detail to document typical pollution problems and remedial actions at uncontrolled hazardous waste disposal sites. Of the nine sites, remedial actions were completely effective at two and partially effective at the other seven. Technologies used represented (1) containment, (2) removal of waste for incineration or secure burial, (3) institution of surface water controls, and/or (4) institution of groundwater controls. (Author's abstract)
W83-00637

SORPTION OF ZINC BY LAKE MICHIGAN SEDIMENTS--IMPLICATIONS FOR ZINC WATER QUALITY CRITERIA STANDARDS,
Wisconsin Univ.-Stevens Point. Dept. of Chemistry.
For primary bibliographic entry see Field 5B.
W83-00643

POWER INDUSTRY WASTES,
Tennessee Valley Authority, Chattanooga.
T.-Y. J. Chu, and H. Olem.
Journal of the Water Pollution Control Federation (Literature Review Issue), Vol 54, No 6, p 990-1002, June, 1982. 2 Tab, 217 Ref.

Descriptors: *Literature reviews, *Powerplants, *Reviews, Nuclear powerplants, Thermal powerplants, Hydroelectric plants, Electric powerplants, *Industrial wastes, Regulations, Environmental effects.

Recent research in the field of power industry wastes as it pertains to water resources is cited in this literature review. Environmental regulations recently issued include the regulatory reform efforts of the Reagan Administration, the amendments to the industrial provisions of the Clean Water Act, and the final Phase II technical stand-

ards for the treatment, storage, and disposal of hazardous wastes under the Resource Conservation and Recovery Act. Hydroelectric power plant research centered on environmental assessments and the siting of new plants. Fossil-fueled power plant research also dealt with environmental assessment and plant sites. Waste characterization, treatment, disposal, and utilization considered the areas of ash disposal, cooling system and cooling water discharge, flue gas desulfurization, and miscellaneous wastes. Nuclear power research included the environmental assessment along with waste characterization, treatment and disposal. Fluidized-bed combustion and waste heat utilization were also considered. (Baker-FRC)
W83-00657

COST-EFFECTIVE PROGRAM FOR COMBINED SEWER OVERFLOW ABATEMENT,
O'Brien and Gere Engineers Inc., Syracuse, NY.
R. C. Ganley, G. N. Kirsch, A. J. Oliver, J. M. Karanik, and R. R. Ott.
Journal of the Water Pollution Control Federation, Vol 54, No 8, p 1215-1223, August, 1982. 10 Fig.

Descriptors: *Combined sewer overflows, *Storm-overflow sewers, *Sewer systems, Combined sewers, Overflow, Onondaga County, *New York, Syracuse, Model studies, Storm water, Storm wastewater, Water quality control.

The magnitude of combined sewer overflow (CSO) problems in Onondaga County, New York, was assessed using the SWMM and simplified SWMM models to analyze the interrelationships between dry weather flow, storm patterns, runoff rates, and sewer system constraints. In addition, monitoring at 25 selected overflows confirmed model results and located areas of high pollutant loading. Evaluation of several abatement alternative options produced a comprehensive master plan based on CSO collection and treatment in drainage areas. The plan included installation of 6400 m of CSO transmission pipelines, construction of 6 CSO treatment facilities, and modification of 2 existing demonstration CSO treatment facilities. The modifications, called the best management practices/system improvements program (BMP) included overflow dam modifications, backwater gate installations, regulator pipe capacity increases, interceptor cleaning, relief sewer construction, interceptor rehabilitation, in-line grit chamber construction, and modifications to allow CSO storage in the existing sewer. Simulation of a 90% storm event on the present and proposed systems showed that total overflow volume will be reduced by 31%, total suspended solids and BOD by 28%, volatile suspended solids and total Kjeldahl nitrogen loadings by 31%, total inorganic P by 26% and fecal coliform loading by 33%. (Cassar-FRC)
W83-00659

NONPOINT-SOURCE POLLUTION CONTROL: A RESOURCE CONSERVATION PERSPECTIVE,
Science and Education Administration, Tifton, GA. Southeast Watershed Research Center.
W. G. Knisel, R. A. Leonard, and E. B. Oswald.
Journal of Soil and Water Conservation, Vol 37, No 4, p 196-199, July-August, 1982. 20 Ref.

Descriptors: Water resources development, *Soil conservation, *Erosion control, *Nonpoint pollution sources, Sediment erosion, Water pollution sources, Land management, Conservation, Pesticide drift, Watershed management, Water quality management, Agricultural runoff, Mississippi Delta.

Some aspects of the Federal Water Pollution Control Acts Amendment of 1972 and the Soil and Water Resources Conservation Act of 1977 are in conflict with each other. Management practices are applied on farm fields for resource conservation, while nonpoint-source pollution control is often carried out on a much larger scale at some point in a stream system. Sediment has been identified as the major nonpoint-source pollutant. Erosion may be effectively controlled by conservation tillage, but the added pesticides required increase the chemical pollution of runoff. Grass or alfalfa buffer strips along channels or streams in the palouse of the Pacific Northwest are an effective means of reducing nonpoint pollution. Tillage of plots to reduce pesticide runoff in the Mississippi Delta area results in increased erosion, while overgrazing in the arid regions of the Southwest causes increased erosion and nonpoint source pollution by sediments. Some management practices recommended for soil conservation or improved water quality are discussed. Better criteria are needed for land use planners to determine what measures are required to meet the increasing demands of food production and environmental quality. (Geiger-FRC)
W83-00665

MANAGING WATER QUALITY IN CHANNEL CATFISH PONDS,
Auburn Univ., AL. Dept. of Fisheries and Allied Aquacultures.
C. E. Boyd.
Journal of Soil and Water Conservation, Vol 37, No 4, p 207-209, July-August, 1982. 3 Fig, 1 Tab, 30 Ref.

Descriptors: *Water quality control, *Water pollution effects, *Eutrophication, *Oxygen demand, *Fish farming, *Catfish, Carbon dioxide, Photosynthesis, Respiration, Oxygen depletion, Fishkill, Toxicity, Aeration.

In channel catfish farming ponds, water quality often becomes the limiting factor to catfish production. Feeding rates must be carefully controlled to prevent phytoplankton blooms. Use of simazine for algae control reduced dissolved oxygen (DO) levels for two months after treatment. As feeding rates are increased, a point is reached where photosynthesis does not produce enough oxygen to satisfy nighttime demands. Oxygen dynamics are affected by temperature, respiration rates, and weather conditions. Carbon dioxide can be removed from ponds by hydrated lime, but there is no effective way to reduce ammonia concentrations. Sodium chloride or calcium chloride protects fish against nitrite toxicity. Water quality deterioration increases fish susceptibility to diseases and parasites. Moderate feeding rates of 50 to 70 pounds per acre daily are recommended. Even at these rates, emergency aeration must be used to prevent low oxygen-related fishkills. (Geiger-FRC)
W83-00666

6. WATER RESOURCES PLANNING

6A. Techniques Of Planning

ESTIMATION OF SMALL-SCALE HYDROPOWER POTENTIAL,
California Univ., Los Angeles. School of Engineering and Applied Science.
D. A. Poppe, and W. W.-G. Yeh.
Journal of the Water Resources Planning and Management Division, Proceedings of the American Society of Civil Engineers, Vol 108, No WR1, p 145-151, March, 1982. 1 Fig, 4 Tab, 12 Ref.

Descriptors: *Small watersheds, *Hydroelectric power, Projections, Watershed management, Electric power production, Electric potential, Electric powerplants, Mathematical studies, Statistical methods, Model studies, *California.

Simplified planning techniques are needed to project the installed capacity and energy yield of potential small-scale hydroelectric powerplant sites. A statistical method has been developed which uses generally available watershed characteristics to determine the hydropower potential of watersheds less than 500 square miles in area. Monthly streamflow data for a 20-year period and reservoir characteristic curve data were used to estimate the hydropower potential for each of 30 small watersheds using a sequential period reservoir routing technique. The values of hydropower potential obtained for 27 of the watersheds were used as the dependent variable in the regression equation used in the statistical model. A separate regression equation relating annual yield to watershed characteristics was used to estimate the annual yields of watersheds for which no streamflow records were available. The annual yield and hydropower estimation equations developed were verified using data from the three remaining watersheds. The results showed that the hydropower potential of small California watersheds can be estimated with reasonable accuracy from watershed characteristics using a stepwise multiple regression model. This model can be directly applied in its present form to most watersheds in California, gaged or ungaged, with or without existing structures, at a relatively low cost. (Carroll-FRC)
W83-00357

WATER RESOURCES AND ENVIRONMENTAL PLANNING USING INTERACTIVE GRAPHICS,
Cornell Univ., Ithaca, NY.
D. P. Loucks, P. N. French, and M. R. Taylor.
Water Supply and Management, Vol 6, No 4, p 303-320, 1982. 11 Fig, 15 Ref.

Descriptors: *Computer programs, *Graphical analysis, *Planning, Maps, Model studies, Data processing, Water resources development, Water management, Flood control, Computers, Automation, Mathematical models.

Interactive computer-aided planning (CAP) programs for linking mathematical models for water and related land resource planning with graphic devices are described. These programs, suitable for use with both alphanumeric and graphic display terminals, also help with adaptation, calibration, and application of planning models to site-specific problems and with interaction of groups of models with data bases. Information, such as graphs, maps, or pictures, may be input by solution of models or by using a digitizing pen and tablet or video digitizing camera. These programs may be used to study specific watershed and river basin development issues and as teaching aids for engineering students. Figures illustrate some of the graphics obtained from the program, for example, a map showing the extent of a flood area from different flood control alternatives. Specific uses for the programs include: (1) forecasting and conjunctive control of surface and subsurface water quantity and quality, (2) studying urban hydrology, (3) predicting flooding from large storms or dam failures, (4) studying hydrodynamics and predicting pollutant concentrations in lakes and estuaries, (5) examining water supply demand caused by energy development schemes, and (6) inputting and manipulating 3-dimensional geographic data bases which have many attributes varying over time. (Cassar-FRC)
W83-00456

OPTIMAL PLANNING OF IRRIGATION DISTRIBUTION AND APPLICATION SYSTEMS FOR A LARGE IRRIGATED AREA,
Idaho Univ., Moscow. Coll. of Engineering.
For primary bibliographic entry see Field 3F.
W83-00616

PRACTICAL APPLICATION OF LINEAR PROGRAMMING AND NETWORK FLOWS - PROCEEDINGS OF THE TECHNOLOGY TRANSFER WORKSHOP.
Canada Centre for Inland Waters, Burlington (Ontario).
Technical Workshop Series No 3, Environment Canada, Inland Waters Directorate, Ottawa, 1982. 128 p, 16 Fig, 1 Tab, 13 Ref. 1 Append.

Descriptors: *Linear programming, *Flow nets, *Computer models, *Large watersheds, *Systems engineering, Systems analysis, Networks, Network design, Multireservoir networks, Flow pattern, Flow profiles, Flow system, Flow, Mathematical models, Mathematical studies, Model studies, *Ottawa River basin.

Workshop participants were exposed to current optimization methodology to assist appropriate application of this methodology to water resources

management problems. Special emphasis was placed on the integration of optimization techniques, specifically for network flows (NF) and linear programming (LP) with non-decision-making simulation models for increasing the effectiveness of current mathematical modeling studies. Three documented large-scale models are discussed in detail: the hydro-configuration modeling system (HCMS), used extensively in Ottawa River basin studies; the Ottawa River regulation modeling system (ORRMS), developed to permit integrated operation of Ottawa River basin reservoirs; and the Great Lakes SYSNET model, a specially-designed optimal solution-seeking simulation model for regulating the entire Great Lakes system. The workshop sought to transfer knowledge and experience to systems/engineering/management/scientific personnel in the successful operation of linear LP and NF, to correct misconceptions concerning systems engineering techniques (e.g., LP and NF), and to identify priorities for further applications of systems engineering techniques as related to management of large water systems. (Zielinski-MAXIMA)
W83-00628

6B. Evaluation Process

DECENTRALIZING WATER RESOURCE PLANNING AND MANAGEMENT,
Prince (Malcolm), Inc., Buffalo, NY.
W. C. Wright, R. Cohen, and J. H. Heath.
Journal of the American Water Works Association, Vol 74, No 7, p 6, 334-345, July, 1982. 5 Fig, 2 Tab, 37 Ref.

Descriptors: Vermont, Virginia, West Virginia.

Successful water planning in eastern states depends not only on recognition of the need for good planning but also on public participation and each state's legislative support and funding to implement plans. Examples of efforts to develop state water plans in eastern states are discussed and compared. The history of water resource development is reviewed, and results of a survey are presented which encompassed 21 eastern states regarding what their efforts and problems associated with water resource affairs had been in the past. A methodology is outlined for states to consider in developing water allocation strategies and a resource planning program. A tabular presentation of water resources planning and management practices for eastern states identifies the lead state planning or coordinating agency or office, the interstate regional planning committee, the Title II interstate river basin commission, the federal interstate water compacts or commissions, and the applicable statute law mandating water resources planning. (Baker-FRC)
W83-00454

DEVELOPMENT PROCESS FOR IMPROVING IRRIGATION WATER MANAGEMENT,
Colorado State Univ., Fort Collins. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 3F.
W83-00458

GROUNDWATER SUPPLY EXPLORATION IN SEMI-ARID REGIONS FOR LIVESTOCK EXTENSION--A TECHNICAL AND ECONOMIC APPRAISAL,
Wellfield Consulting Services, Baborone (Botswana).
J. L. Farr, P. R. Spray, and S. S. D. Foster.
Water Supply and Management, Vol 6, No 4, p 343-353, 1982. 4 Fig, 2 Tab, 6 Ref.

Descriptors: *Groundwater availability, *Economic aspects, *Exploration, *Water supply development, Benefits, Cost-benefit analysis, *Botswana, Livestock, Semiarid lands, Geohydrology, Drilling, Boreholes, Well development, Wells.

The technical feasibility and cost effectiveness of several groundwater exploration techniques are evaluated for southern Botswana, where hydrogeological conditions are both unfavorable and relatively unknown. Livestock rearing is a major activity in this semi-arid region. Overall unit search costs (cost of 1 well in a 50-well field) are computed for 5 exploration methods: grid controlled drilling (15 trial production wells), $1500; geologically controlled drilling (10 trial production wells), $1300; long traverse geophysics (300 km resistivity/magnetic traverse with some soundings, 5 trial production wells), $3400; short and long traverse geophysics (300 km resistivity/magnetic traverse, 5 detailed sites, 2 exploratory wells), $4400; and hydrostratigraphic exploration (300 km resistivity/magnetic traverse, 5 exploratory wells, 5 trial production wells, 3 observation wells, aquifer pumping tests, and laboratory test), $6900. Costs are all bases on some return from selling successful production wells. Formulas are given to choose a suitable exploration method, given the average cost of drilling a production borehole and the success rate following use of a given exploration method. The maximum justifiable expenditure on groundwater search can be determined from average cost of drilling a production borehole and the success rate of wildcat drilling in the area. Minimum justifiable improvement in borehole success rate can be calculated from the same information. These equations revealed that in the basalt-free area, wildcat drilling or controlled drilling are economically justified. In the basalt-capped area, grid controlled drilling and geologically controlled drilling are the best choices. (Cassar-FRC)
W83-00459

THE ECONOMICS OF MUNICIPAL WASTEWATER REUSE,
Pennsylvania State Univ., University Park.
C. E. Young.
Journal of the American Water Works Association, Vol 74, No 7, p 358-361, July, 1982. 4 Fig, 1 Ref.

Descriptors: *Water reuse, *Wastewater disposal, *Economic aspects, Wastewater treatment, Wastewater composition, Municipal wastewater, Land disposal, Reclaimed water, Water conservation, Water shortage, Water supply, Water demand.

A model was developed to describe the economics of wastewater reuse. The supply and demand are illustrated in graphical form as two intersecting lines in X-form. The coordinates are: price of wastewater in dollars and amount of available wastewater in cu m. The point at which the lines intersect gives the equilibrium price and quantity. The value of the wastewater depends on quantity and quality as well as intended use. For example, a wastewater with high levels of salt, heavy metals, organics, or pathogens may be undesirable for reuse in agriculture. Conversely, nutrients and organic matter may add to its value in irrigation. Other uses require wastewaters of varying quality: corrosiveness is undesirable in industrial reuse applications; pathogens, in municipal or recreational consumption. The cost of supplying wastewater is based on quantity (large volumes cost less per unit volume than small volumes), desired wastewater characteristics (high level of treatment is more costly), and alternative disposal options. Other factors affecting the reuse of wastewater are availability of other water sources, public concerns over wastewater reuse, location of buyers and sellers of wastewater, transmission costs, and government policies. (Cassar-FRC)
W83-00465

ANALYSIS OF WATER SUPPLY COSTS IN THE WASHINGTON (D.C.) AREA,
Municipal Environmental Research Lab., Cincinnati, OH. Drinking Water Research Div.
R. M. Clark, J. I. Gillean, and J. A. Goodrich.
Journal of the American Water Works Association, Vol 74, No 7, p 6, 347-357, July, 1982. 9 Fig, 8 Tab, 21 Ref.

Descriptors: *Metropolitan water management, *Water resources development, *Planning, Water supply, Water management, Reservoirs, Water storage, Water conveyance, Baltimore, *District of Columbia.

Increasing reliance on the Potomac River as a source of water for the Washington D.C. area has prompted this study of the most cost-effective ways to ensure an extension of water supply availability. Reservoirs provide a possible solution to the Washington metropolitan area water problems. The construction of the Bloomington Reservoir has gone far toward alleviating possible problems. Use of reclaimed wastewater is an extremely expensive solution. In addition, undefined health problems may also be associated with renovated wastewater. The current risks of water shortages are small, but will increase significantly over the next 50 years, assuming current population trends continue. Consideration should also be given to the eventual construction of an additional reservoir to stabilize Potomac flow. Interconnections, although apparently attractive, are expensive, potentially damaging to the environment, and limited in capacity. Finished water connections could be encouraged to spread the peak demand. The possibility of an emergency link to the Baltimore water supply should be explored. The biggest problem in Washington Municipal Water Development may be political in nature. (Baker-FRC)
W83-00467

STEADY-STATE ECOSYSTEM MODELING FOR LAKE MANAGEMENT,
Maine Univ. at Orono. Land and Water Resources Center.
For primary bibliographic entry see Field 5G.
W83-00610

EVALUATION OF PUBLIC PARTICIPATION IN THE YADKIN-PEE DEE LEVEL B RIVER BASIN STUDY,
North Carolina State Univ. at Raleigh.
J. Wright.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-125161, Price codes: A09 in paper copy, A01 in microfiche. Water Resources Research Institute Report No 181, North Carolina State University, Raleigh, June 1982. 152 p, 6 Fig, 47 Tab, 6 Ref, 3 Append. OWRT B-120-NC(2), 14-34-0001-9126.

Descriptors: *Public participation, *Public opinion, *Surveys, *River basin development, *Regional development, Attitudes, Social participation, Policy making, Public policy, Environmental policy, River basins, Catchment areas, Water resources development, Management planning, Project planning, Education, Decision making, *North Carolina, *Yadkin-Pee Dee River basin.

For useful public participation (PP) in water resources planning, the public must learn how the planning process is organized and how they may participate effectively. A case study was made of the North Carolina PP effort in the Yadkin-Pee Dee Level B River Basin Study using observation, document analysis, and a series of surveys of various groups of public's and planners. This study addressed questions concerning: the appropriateness/utility of viewing PP in planning as an educational process; components of the PP effort, and relationships found between them and evidences of learning; factors shaping the PP effort; and problems/issues encountered. The results of this study indicated that, while more public involvement was associated with more public learning, no one technique was the most superior. Further, while planners did not develop an explicit rationale (i.e., a means-ends statement) for the PP effort, they considered it successful since no serious public objections were raised concerning the final plan. The PP effort was shaped less by preconceived ideas of representativeness, desired outcomes, and means-ends relationships than by changing demands and circumstances imposed by the nature of the planning project, the sponsoring agency, and (to a lesser extent) the publics. (Zielinski-MAXIMA)
W83-00612

ECONOMIC EVALUATION OF GROUNDWATER POLICY ALTERNATIVES IN THE NORTHERN GREAT PLAINS,
Nebraska Univ.-Lincoln. Dept. of Agricultural Economics.

For primary bibliographic entry see Field 4B.
W83-00623

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

ENERGY,
California Univ., Berkeley.
M. N. Christensen, G. W. Harrison, and L. J. Kimbell.
In: Competition for California Water, Alternative Resolutions, Engelbert, E. A., ed., University of California Press, Berkeley, 1982. p 76-97, 5 Tab, 30 Ref.

Descriptors: *Energy conversion, *Water costs, *Water demand, *Long-term planning, *Water allocation, Environmental quality, Water use, Water supply, Water use efficiency, Alternative water use, Estimated costs, Energy sources, Resource allocation, Future planning.

Rising energy costs are affecting water supply/disposal and aggregate levels of demand. In California's long-range water planning, energy is significant in that extracting and processing it consumes water; it is used to move and treat water, so its price affects supply costs; and rising prices and shifting energy resources are changing economic patterns and, thus, future demands. Five long-range variables are discussed. The first is rising energy prices which are directly tied to production costs, supply and demand, alternative energy sources, political instabilities, and rate structures. Variable 2, water used in energy production, is for now a marginal concern in terms of quantity and quality of water used. The requirements to meet levels of demand can vary, depending on the mix of supply technologies used. Variable 3, energy used in water supply, involves moving water, treating it prior to use, and treating wastewater before discharge. Rising costs will mostly affect users having a high water use ratio to product value, i.e., agriculture. Variable 4 discusses California's economy and the interrelationships of industries, i.e., how an industry's output affects others. Changing circumstances make up variable 5, and addresses marginal costs (new sources and actual costs of water/energy), externalities (environmental systems/regulations, costs not borne by end-users), and domestic and international factors. Three alternative for future water policy are: maintaining the status quo; marketlike allocations of water; and developing further supplies. Institutional changes aimed at more effective water use is the preferred approach, rather than physical development aimed at increasing supplies. (Atkins-Omniplan)
W83-00543

THE ECONOMICS OF WATER ALLOCATION,
California Univ., Davis.
For primary bibliographic entry see Field 6E.
W83-00544

THE ECONOMIC EFFICIENCY OF FLOOD PLAIN DEVELOPMENT,
Tennessee Univ., Knoxville. Dept. of Agricultural Economics and Rural Sociology.
For primary bibliographic entry see Field 6F.
W83-00545

6D. Water Demand

ANALYSIS OF WATER SUPPLY COSTS IN THE WASHINGTON (D.C.) AREA,
Municipal Environmental Research Lab., Cincinnati, OH. Drinking Water Research Div.
For primary bibliographic entry see Field 6B.
W83-00467

AGRICULTURE,
California Univ., Davis.
For primary bibliographic entry see Field 3F.
W83-00540

MUNICIPAL AND DOMESTIC USE,
California Univ., Berkeley.
W. H. Bruvold, F. G. Mittlebach, and C. Werner.
In: Competition for California Water, Alternative Resolutions, Engelbert, E. A., ed., University of California Press, Berkeley, 1982. p 37-58, 6 Fig, 2 Tab, 47 Ref.

Descriptors: *Water use, *Alternative water use, *Water scarcity, *Water supply, *Population dynamics, Municipal water, Water shortage, Competing use, Water use efficiency, Urban planning, Potable water, Consumptive use, Water rights.

The current estimate of California's urban water usage is 200 gallons per capita per day. Yearly urban consumption is about 13.5% of the total supply and, if supplies remain constant until 2020, urban use would require 20.5% of the total available. The 1980 population estimate is 23 million and is projected at 35 million in 2020; however, the growth rate will vary according to region, with nine counties in the southern part of the state expected to absorb about 56% (6.7 million people) of the additional growth. Some farmland may be converted to urban use, but in formerly heavily irrigated areas the demands may be equivalent to farm demands. Controlling urban development and conservation are critical to future water supply management. Manipulating the demand (per capita use times population) can be achieved by pricing or conservation measures, or by population growth. Limiting growth, such as by zoning regulations, has economic, legal and political implications which have not been explored fully, but it is clear that in the future stretching supplies by conservation or resue versus investing in expansion of delivery systems will be at issue. Three scenarios for California's water development as it afects urban usage are considered. The first involves increasing the supply to the urban sector; the second involves control over urban development in regions with the fastest population growth; and the third involves legal, institutional and organizational changes to support redistribution and efficient use of supplies. (Atkins-Omniplan)
W83-00541

INDUSTRY,
California Univ., Berkeley.
M. B. Teitz, and R. A. Walker.
In: Competition for California Water, Alternative Resolutions, Engelbert, E. A., ed., University of California Press, Berkeley, 1982. p 59-75, 4 Tab, 19 Ref.

Descriptors: *Industrial water, *Urban planning, *Water scarcity, *Water supply, *Market value, Water use, Economic aspects, Water shortage, Competing use, Water use efficiency, Water users, Population dynamics.

Industrial and commercial activities, including private sector manufacturing, transportation, trade and services accounts for more than 75% of California's employment and 84% of its gross income. Whereas industry only uses 6% of the water versus 86% for agriculture, it has a substantially higher output-value-to-water use ratio. Conflicts over industrial water use will probably focus on transferring water from agriculture to industrial/urban use, and developing incremental supplies for industrial development in areas where transfers are not feasible. Industry now gets water from public authorities or through self-supply (50% statewide) under private water rights or municipal systems. Projections of future demand are based on speculations about economic activity and population growth, which by 2020 is estimated at 34.9 million. Three scenarios are presented to consider supply variables. The first is the no project scenario whereby no major institutional or legal changes occur and supply changes only marginally. The second is the development scenario where development of further water supplies occurs through a series of projects without major institutional shifts, i.e., the Peripheral Canal project. The third is the reallocation scenario, whereby reallocation of water is pursued as an active policy with major changes in law and institutions providing defined and separable property rights in water; no major increase occurs in supply; and development of a marketlike system for sale and exchange of water among willing parties takes place under state sponsorship and regualtion. Industry may best be served by the last scenario. (Atkins-Omniplan)
W83-00542

ENERGY,
California Univ., Berkeley.
For primary bibliographic entry see Field 6C.
W83-00543

COLORADO WATER RIGHTS - AN ENGINEER'S CASE STUDIES,
Rice (Leonard) Consulting Water Engineers, Inc., Denver, CO.
For primary bibliographic entry see Field 6E.
W83-00675

WATER USE IN THE MISSISSIPPI GULF COAST COUNTIES, 1980,
Geological Survey, Jackson, MS. Water Resources Div.
J. A. Callahan.
Available from the OFSS, USGS Box 25425, Fed. Ctr. Denver, CO. 80225. Price codes: $7.00 in paper copy, $1.00 in microfiche. Geological Survey Open-File Report 82-512, 1982. 13 p, 2 Fig, 4 Tab, 6 Ref.

Descriptors: *Hydrologic data, *Water use, *Water supply, Industrial water, Municipal water, Groundwater, Surface water, Brackish water, *Mississippi, Mississippi Gulf Coast.

The population served by public water systems in the three counties of Mississippi's Gulf Coast increased from about 227,000 to nearly 253,000 between 1975 and 1980. Water use by public systems increased from about 27.6 million gallons per day to more than 31.3 million gallons per day. Self-supplied industrial use of ground water decreased from about 18.4 to 17.7 million per day, and that for fresh surface water increased from about 42.3 to 56.1 million gallons per day. Total freshwater was including that for rural domestic supplies, increased from about 92.0 to 109 million gallons per day. Industrial use of brackish surface water decreased from about 790 to 660 million gallons per day. (USGS)
W83-00680

6E. Water Law and Institutions

NEW DEQ WATER POLICY MORE RECEPTIVE TO CITY NEEDS,
League of Iowa Municipalities, Des Moines.
For primary bibliographic entry see Field 5F.
W83-00423

ADJUDICATORY HEARINGS AS PART OF THE NPDES HEARING PROCESS,
Washington Univ., Seattle. Dept. of Civil Engineering.
G. M. Zemansky, and R. O. Zerbe, Jr.
Ecology Law Quarterly, Vol 9, No 1, p 1-66, 1980. 279 Footnotes.

Descriptors: *Permits, *Adjudication procedure, *Water pollution control, Environmental Protection Agency, National Pollution Discharge Elimination System, Water law, Legal aspects, Regulations, Legislation, Federal Water Pollution Control Act, Public participation, Judicial decisions, Law enforcement, State jurisdiction.

Procedures for adjudicatory hearings conducted as part of the National Pollution Discharge Elimination System (NPDES) programs administered by the EPA are described. Since state-run NPDES programs can experience the same problems, it is suggested that proposed changes in the EPA permit program also be applied in the state programs. The 173 hearing requests received in Region X (Alaska, Idaho, Washington, and Oregon) from 1972-1979 are reviewed and analyzed. About 1/3 of the issued NPDES were challenged by requests for hearings. Over half of the

challenges resulted in changes favorable to the dischargers. Public participation has been minimal, limited to highly visible dischargers. Parties challenged permits for several reasons: disagreement with effluent limitations, expiration dates, or requirements for monitoring and reporting; expectation of favorable treatment; errors in the drafting stage; tactics to delay compliance; and a means of establishing communication with the agency. Reasons for delayed resolution of contested permits were: the inherent advantages in maintaining the status quo and administrative delay. Reasons for decisions favorable to 50% of the discharges were: minor nature of the challenge, failure to issue guidelines for many pollutants, breach of nondiscretionary duties by the EPA, and lack of citizen involvement. In June 1979 some changes were promulgated to correct some of the weaknesses and abuses. (Cassar-FRC)
W83-00424

PROTECTING STREAMFLOWS IN CALIFORNIA,
California Univ., Berkeley. School of Law.
A. B. Lilly.
Ecology Law Quarterly, Vol 8, No 4, p 697-723, 1980. 186 Footnotes.

Descriptors: *Instream flow, *Appropriation, Streamflow, *Legal aspects, *California, *Water law, Water rights, Water allocation, Judicial decisions, Beneficial use, Fish, Wildlife, Diversion, Political aspects, Legislation, Wild rivers, Rivers, Water management.

The protection of fish and wildlife by the same system of appropriative water rights that protect other water uses is encouraged. The development of California water law and the current administrative system of water allocation are discussed. Present strategies for protecting beneficial instream uses are inadequate. Partial protection is provided by federal and state statutes on wild and scenic rivers, statutory and common law doctrines such as the public trust doctrine, the California Water Resources Board, Constitutional restrictions, and the Water Code. However, minimum streamflows are not specified, instream values are often ignored in project design, and instream advocates must bear the burden of proof. The California Water Resources Control Board recently adopted, but failed to implement, regulations for establishing instream flow requirements to maintain beneficial instream uses. The author suggests that instream uses could compete with offstream uses more equally for available water by attaching appropriative rights to water serving instream uses. Instream appropriation permit holders would not be required to defend instream uses against each proposed offstream appropriation. Instream appropriations would also protect instream users against future exercise of dormant riparian rights. Several cases are cited in which administrative and judicial rejection of instream appropriations occurred. It is not likely that the ideal system will be adopted because of political pressures from industry and agricultural interests. (Cassar-FRC)
W83-00425

BEYOND SECTION 858: A PROPOSED GROUND-WATER LIABILITY AND MANAGEMENT SYSTEM FOR THE EASTERN UNITED STATES,
National Energy Law and Policy Inst., OK.
J. S. Lowe, L. C. Ruedisili, and B. N. Graham.
Ecology Law Quarterly, Vol 8, No 1, p 131-161, 1979. 135 Footnotes.

Descriptors: *Water law, *Liability, *Water management, *Legal aspects, Wisconsin, American rule, *Groundwater management, Water rights, Water pollution, Beneficial use, Water use, Water transfer, Water shortage, Water allocation, Appropriation, Administration, Judicial decisions, Regulations.

Problems with present groundwater liability rules and a proposed solution for management in the eastern U.S. are presented. The common law of absolute ownership of groundwater was abandoned by most states shortly after 1900 and replaced with the American rule of reasonable use. This restricted a landowner's groundwater rights by permitting reasonable withdrawals. The rigidity of the American rule takes no account of the relative values to the community of different water uses. A landowner can use, or even waste, groundwater on his premises as long as it does not affect the neighboring users. On the other hand, a user is liable for damages if he harms other landowners even in the process of using water for acceptable purposes. In 1974 Wisconsin adopted the Second Restatement of Torts' modification of the American rule: Section 858. The Restatement incorporates all the grounds of liability recognized by common law but removes some of the defenses against liability by weighing the value of different uses. Section 858 has been criticized because it does not consider water shortage situations, is uncertain, frustrates good planning, and does not protect the public interest in preservation of groundwater quality and quantity. Proposed modifications to these laws would consider the differences between locations liberally endowed with clean water and those facing shortages and pollution. In the noncritical areas the first user principle, the priority use rule, and the comparative cause rule are more suitable than Section 858. In case of critical groundwater areas new laws are necessary to allow a government agency to manage groundwater under 3 classifications of problem areas: emergency critical, temporary critical, and permanent. These proposed changes in the law would provide a mechanism for controlling water use in the event of shortage or degradation. (Cassar-FRC)
W83-00439

THE GANGES BASIN AND THE WATER DISPUTE,
Ministry of Power, Water Resources and Flood Control, Dacca (Bangladesh).
For primary bibliographic entry see Field 4A.
W83-00455

EAST IS WEST AND WEST IS WEST: HAVE THE TWAIN MET.,
T. E. Cahill.
Journal of the American Water Works Association, Vol 74, No 7, p 4, 332-333, July, 1982. 15 Ref.

Descriptors: *Water rights, *Legal aspects, *Water shortage, Water demand, Water resources development, Riparian rights, Colorado, Property rights.

States in which water use laws are based on the riparian doctrine are becoming increasingly aware of the limitations of this ancient common law. From Biblical times up till the moment of the Industrial Revolution, water was still used mainly to run small gristmills and for domestic purposes. Even so, legal issues of these times were supported by the idea that there could be property rights to the use of running water which stemmed from the rights of those through whose land the stream flowed. As more and bigger industries found greater need forwater, either as a power source or for waste disposal, the riparian doctrine emerged. Early cases established the 'natural flow' theory. The 'reasonable use' theory then emerged, which modified the natural flow doctrine and put emphasis on a full and beneficial use of the advantages of the stream or lake and gave each riparian proprietor a privilege to make a reasonable use of water for any purpose, provided only that such use did not cause harm to the reasonable uses of others. Conflicts between miners and irrigators caused the Colorado Supreme Court to hold that riparian rights were unsuitable for the arid west. Prior appropriation was Colorado's common law. As competition for diminishing water supplies increased outside the West, the state legislatures became more and more involved in water allocation. Ample evidence exists to demonstrate that existing uses will be protected in water-short areas, and as shortages intensify, simple statutes will become more complex. (Baker-FRC)
W83-00464

NATIONAL DRINKING WATER ADVISORY COUNCIL AND WATER UTILITY COUNCIL: WHAT DO THEY DO.,
Manchester Water Works, NH.
For primary bibliographic entry see Field 5G.
W83-00503

THE ECONOMICS OF WATER ALLOCATION,
California Univ., Davis.
R. E. Howitt, D. E. Mann, and H. J. Vaux, Jr.
In: Competition for California Water, Alternative Resolutions, Engelbert, E. A., ed., University of California Press, Berkeley, 1982. p 76-97, 1 Fig, 6 Tab, 37 Ref.

Descriptors: *Resource allocation, *Water scarcity, *Water demand, *Cost-benefit analysis, Water supply, *Water exchange, Water rights, Model studies, Agriculture, Industrial constraints, Electric power costs, Water districts, Market value, Marginal costs.

Water institutions that have served California well in the past are not well-suited to either current conditions or those anticipated for the next 40 years. Three water use scenarios are examined using an interregional trade model to illustrate some costs associated with preserving current institutions in the face of increasing competition for water. Water could be transferred between geographical regions and between agricultural and urban sectors, and would occur when a potential user is willing to pay the market price, plus transportations costs. Temporal changes in supply, demand, and transfer prices are estimated in the model beginning with 1980 and continuing through 2020. In scenario one, it is assumed that current institutions are maintained and no new water supplies are made available. Water prices will increase sharply in response to increased energy costs and competition. In scenario two, current institutions are maintained and new supplies are made available when users are willing to defray their costs. Urban sectors will benefit from the new supplies and see large reductions in water prices and modest increases in quantities available. Regional and sectoral markets would be allowed in scenario three, permitting voluntary trading of water. Northern agriculture would sell to the northern urban sector, and the Imperial Valley would sell to the southern urban areas. This limited marketlike system would save up to 2 million acre-feet of water annually and would benefit buyers and sellers in an amount over $70 million in 1980 and $83 million in 2020. These institutional changes are only a fraction of the costs of capital facilities to produce similar benefits. (Atkins-Omniplan)
W83-00544

OIL SPILL CLEANUP FULFILLS AIM OF FEDERAL WATER POLLUTION CONTROL ACT,
For primary bibliographic entry see Field 5G.
W83-00566

'PLAIN MEANING' DECISION CLARIFIES STANDARD FOR EFFLUENT LIMITATIONS,
S. Weckesser.
Natural Resources Journal, Vol 22, No 2, p 455-465, April, 1982. 71 Ref.

Descriptors: *Effluent limitations, *Legal aspects, *Water pollution control, Technology, Cost analysis, Financial aspects, *Water quality standards.

The Administrator of the EPA is authorized under the Clean Water Act to promulgate effluent limitations for private industrial sources. Conventional pollutants are subject to the best conventional pollutant control technology standard (BCT). Thirty-four paper and chemical manufacturers, food processing companies and trade associations sought judicial review of the actions challenging the BCT regulations on several grounds. The petitioners argued that the statute required EPA's proposed BCT guidelines to pass two reasonableness tests. EPA responded that the statute did not require a cost-effectiveness test, but rather only a POTW (publicly owned treatment works) cost-comparison standard to arrive at BCT regulations for industry.

EPA contended that the second clause in the relevant portion of the statute set forth the benchmark of reasonableness required by the first clause. In the present case the decision is an economic victory for the industries in that the fourth circuit's decision held that the statute required a cost-effectiveness test. The American Paper Institute's counsel reported that EPA rules, had they been upheld, would have cost $2 billion for almost no clean-up at all. A point always exists at which the costs of pollution control are no longer warranted by resulting incremental benefits. EPA's evaluation of the reasonableness of the costs would seem to have given adequate consideration to the incremental benefits as compared to the costs. It is felt that this decision may lead to lower standards, allowing a greater discharge of conventional pollutants. In addition, the process of conducting this test will lead to delay in promulgation of standards, and delay means economic benefits to industry. (Baker-FRC)
W83-00567

PALEFACE, REDSKIN, AND THE GREAT WHITE CHIEFS IN WASHINGTON: DRAWING THE BATTLE LINES OVER WESTERN WATER RIGHTS,
B. K. Orem.
San Diego Law Review, Vol 17, No 2, p 449-489, March, 1980. 194 Footnotes.

Descriptors: *Water rights, *Reservation doctrine, *Jurisdiction, Water law, Semiarid lands, Legal aspects, Water allocation, Water shortage, Winters doctrine, Indians, Adjudication procedure, State jurisdiction, Federal jurisdiction, Relative rights, Judicial decisions.

The conflicts among Indian and federal reserved water rights (Winters doctrine) and state vested water rights in the semiarid Western U.S. are examined. The legally superior federal reserved water rights preempt later dated state water claims. This situation disrupts state water systems and frustrates sound planning. Indians claim expansive reserved water rights under the doctrine of implied reservation of water rights. This involves marketing of water for off-reservation uses, destroying state water management schemes and possibly preempting established uses. Conflicts exist between federal and state claims, between federal and Indian claims, and between state and federal-Indian claims. Although the Supreme Court has recently limited reserved water rights for non-Indian federal reservations to the original purposes, powerplants, energy development, and water marketing are not included. Until the conflicts are settled by permanently quantifying Indian and federal rights in coordination with state laws, water users face possible loss of water rights without compensation. (Cassar-FRC)
W83-00584

NATIONAL ACID PRECIPITATION ASSESSMENT PLAN.
For primary bibliographic entry see Field 5G.
W83-00607

AN ECONOMIC EVALUATION OF CITIZEN SUITS,
Clemson Univ., SC. Dept. of Economics.
H. H. Macaulay, and C. W. Van Deusen.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-125229, Price codes: A05 in paper copy, A01 in microfiche. Water Resources Research Institute Technical Report No 94, Clemson University, Clemson, South Carolina, August 1981. 76 p, 49 Ref. OWRT B-104-SC(1), 14-34-0001-7185.

Descriptors: *Economic evaluation, *Legal review, *Liability, *Public rights, *Water pollution, Economic aspects, Public participation, Civil law, Legal aspects, Law enforcement, Building codes,Judicial decisions, Negligence, Ordinances, Regulations, Environmental effects, South Carolina.

Water pollution problems can be analyzed in economic terms as scarcity of an asset whose use is sought by many. Some groups, however, have not enjoyed as much of their preferred use of water quality as they would like at the effective zero price, and have reported to litigation. Courts traditionally have not granted standing to prospective litigants unless the latter could show damage resulting from illegal action by another party. Those seeking their preferred uses through the courts have generally desired environmental purity. This position is popular, and courts have often granted standing where damage has occurred, ignoring the requirement that there must also be a violation of law. Damage frequently occurs whenever one party outbids/undersells another, but such activities are not illegal and do not justify standing. Some laws of the 1970's have granted standing (and therefore, property rights), by allowing citizen suits. Further, by allowing suits based on damage, the courts have, in effect, created new property rights, but decisions in most of these cases have reflected political rather than economic considerations. While certain individuals/groups have property rights in the environment, the rights are not saleable/useable by owners in alternative ways. Hence, the results will create economic inefficiency. (Zielinski-MAXIMA)
W83-00619

LEGAL LIABILITY OF RECLAIMED WATER SYSTEM PROPRIETORS,
Brown and Caldwell, Pasadena, CA.
H. Zeitzew.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-125237, Price codes: A11 in paper copy, A01 in microfiche. Office of Water Research and Technology, Water Reuse Report OWRT/RU-82/5, November 1980. 2 Fig, 6 Tab, 200 Ref, 4 Append. C-90118-R(9455)(1), 14-34-0001-9455.

Descriptors: *Reclaimed water, *Liability, *Civil law, *Regional analysis, *Environmental protection, Evaluation, Legal aspects, Legal review, Western U.S., Damage, Water reuse, Wastewater renovation, Public health, Public rights, Environmental impact statement, Environmental effects.

An evaluation was made of the legal liability of proprietors of reclaimed water systems under existing civil law in five arid western States (Arizona, California, Colorado, Nevada, and New Mexico) where opportunities of water reuse were believed to be the greatest. Model regulatory procedures and legislative enactments were developed and proposed to overcome the identified existing legal barriers to water reuse. This evaluation primarily addressed the point of view of a potential defendant (i.e., the supplier of the reclaimed water) in a lawsuit brought by an injured plaintiff as a means of alerting potential defendants of their possible vulnerability under laws of product liability (and other relevant legal theories), and to propose effective preventive measures. Three areas are discussed: potential health risks associated with specific reuse applications; a review of legal theories under which liability for damages could be imposed; and a compilation of the elements of an effective product integrity and injury prevention program which would minimize potential health risks and potential exposure to liability for damages. Potential liability could constitute a similar barrier to expanded water reuse in other States. (Zielinski-MAXIMA)
W83-00620

COLORADO WATER RIGHTS - AN ENGINEER'S CASE STUDIES,
Rice (Leonard) Consulting Water Engineers, Inc., Denver, CO.
G. W. Fassett.
Journal of the American Water Works Association, Vol 74, No 7, p 4, 324-331, 1982. 3 Fig, 4 Tab, 2 Ref.

Descriptors: *Water rights, *Water allocation, *Legal aspects, Hydraulic engineering, Water use, Water resources development, Resource allocation, Available water, Water supply, Water demand, *Colorado.

The studies water engineers must make to support a contemplated change in the use and diversion point of water rights under the prior appropriation doctrine are described. The growing community of Aurora, Colorado, a suburb of Denver, must acquire rights to additional water for municipal use. In order to determine as nearly as possible the actual amount of available water that previously has been used for agricultural irrigation detailed engineering studies were required. It was also necessary to determine the influence of groundwater on the consumptive use of the irrigated pasture. To determine the transferable consumptive use associated with applied irrigation water, procedures were developed that encompassed all of the technical considerations previously used. In the second case study, the need to augment water supplies for the Telluride, Colorado ski area is discussed. As with the first case, an augmentation plan, supported by detailed water rights engineering studies, must be filed with the Colorado water court for approval. All appropriators within the San Miguel River watershed have an opportunity to object to the proposed plan and to protest evidence if they believe implementation of the plan will injure their water rights. Under the doctrine of prior appropriation, water is allocated on a first in time, first in right basis, and water users' vested rights are protected from injury through a system of procedures based on statutory and case law. The application of these procedures to the development of water resources requires water rights engineering involving a full range of hydrologic and hydraulic techniques. (Baker-FRC)
W83-00675

6F. Nonstructural Alternatives

DECENTRALIZING WATER RESOURCE PLANNING AND MANAGEMENT,
Prince (Malcolm), Inc., Buffalo, NY.
For primary bibliographic entry see Field 6B.
W83-00454

THE ECONOMIC EFFICIENCY OF FLOOD PLAIN DEVELOPMENT,
Tennessee Univ., Knoxville. Dept. of Agricultural Economics and Rural Sociology.
W. M. Park, and W. L. Miller.
Water Resources Research Center Technical Report No 141, May, 1982. Purdue University, West Lafayette, Indiana. 84 p, 7 Fig, 2 Tab, 52 Ref.

Descriptors: *Economic efficiency, *Cost-benefit analysis, *Floods, *Flood plain zoning, *Resource allocation, Costs, Insurance, Social costs, Flood control, Maximum probable floods, Flood damage, Regression analysis, Model studies, Public policy, Planning.

In recent years, concern has increased over the rise in real average annual damages due to flooding. Federal flood control policies may have accelerated the problem because of expectations of future improvements and a downplaying of flood danger. This study examines resource allocation and develops a theoretical framework to analyze flood plain development decisions. Traditional nonstructural flood control measures include flood insurance and restrictive zoning. A multiple regression model was used to determine the significance of social welfare losses from resource over-allocation. Logansport, Indiana was studied to explore the extent of over-allocation in flood prone areas and to assess alternative corrective policies. The model's basic conclusions are that before the Federal Flood Insurance Program of 1974, residential property values were less than fully discounted for the flooding potential; overdevelopment had occured and there were social welfare losses. When an insurance program, via its premiums, reflects the expected annual flood damage on each parcel of land, the market would allocate land to its most productive use and guide investment decisions to the optimal level. However, the program costs of the market-related insurance alternative might favor zoning restrictions, even when social welfare losses from zoning bans on development are included. The insurance alternative could cost four to ten times the cost of the simple zoning alternative, which is estimated at $38,000 to $60,000. Logansport would benefit from a management

strategy and zoning restrictions would provide improved resource allocation at a lower cost than the Federal Flood Insurance Program. (Atkins-Omniplan)
W83-00545

TREATMENT COSTS SAVINGS THROUGH MONTHLY VARIABLE EFFLUENT LIMITS,
Jordan, Jones and Goulding Inc., Atlanta, GA.
H. F. Reheis, J. C. Dozier, D. M. Word, and J. R. Holland.
Journal of the Water Pollution Control Federation, Vol 54, No 8, p 1224-1230, August, 1982. 5 Fig, 2 Tab, 8 Ref.

Descriptors: *Standards, *Effluent limitations, *Costs, Dissolved oxygen, Operating costs, Capital costs, Seasonal variation, Oxygen, Wastewater treatment, Advanced wastewater treatment, *Georgia.

A method for developing monthly variable effluent limits is based on estimating the 7-day 10-year minimum streamflows (7Q10) for each month rather than the yearly 7Q10. The monthly minimum streamflows are used with monthly stream temperature and other water quality characteristics in a dissolved oxygen model to calculate the effluent limits to meet stream standards. Generally, effluent standards are most stringent in the dry months of summer and early autumn. The flexibility of these standards allows some municipalities to discharge secondary effluent for 4-5 months of the year and use advanced treatment for the remaining months, saving considerable treatment costs compared with year-round advanced treatment. Application of this method was made to 19 treatment facilities in Georgia, revealing possible savings of up to 16% in capital costs and up to 19% in operating costs. It was estimated that use of monthly variable effluent limits by wastewater treatment facilities in the state of Georgia could save $50 million in capital costs and $4.2 million in annual operating costs. On a national scale, application of the method could save hundreds of millions of dollars annually. (Cassar-FRC)
W83-00660

6G. Ecologic Impact Of Water Development

COASTAL ZONE DEVELOPMENT: MITIGATION, MARSH CREATION, AND DECISION-MAKING,
Stanford Univ., CA. Program in Human Biology.
M. S. Race, and D. R. Christie.
Environmental Management, Vol 6, No 4, p 317-328, July, 1982. 3 Tab, 50 Ref.

Descriptors: *Wetlands, *Marsh management, *Coastal zone management, Marshes, Salt marshes, Decision making, Mitigation, Coastal marshes, Estuaries, Regulations, Environmental effects, Planning, Aquatic habitats, Water policy, Permits, Marsh plants, Vegetation, Land development, Dredging, Fill permits.

Marsh creation as a mitigation technique should not be used to justify destruction of natural wetlands and substitution with man-made marshes. Marsh creation may be effective in minimizing damage caused by construction, in abating shoreline erosion, and in returning degraded coastlands to tidal influence. Although the net acreage of wetlands may not change as a result of mitigation of development, there is insufficient evidence that man-made marshes are comparable to natural marshes in structure and function. Different states have varying requirements for wetlands mitigation. These are reviewed for 11 coastal states. Mitigation policies in one area may not be applicable to other regions or may adversely affect other estuarine habitats. Decision makers must not be influenced by developers who prepare extensive mitigation plans to justify destruction of natural marshes. This is especially critical in areas where natural wetlands have already been reduced by extensive filling and development. Rather, decisions should be based on: (1) the fact that present knowledge of ecological effects of marsh creation is still limited, (2) the trade-offs involved, and (3) the state's defined standards and policies. (Cassar-FRC)
W83-00430

THE ENCOURAGEMENT OF FRESHWATER CRAYFISH POPULATIONS BY ATTENTION TO THE CONSTRUCTION AND MAINTENANCE OF WATERWAYS,
J. B. Hogger, and R. S. Lowery.
Journal of the Institution of Water Engineers and Scientists, Vol 36, No 3, p 214-220, May, 1982. 2 Fig, 3 Tab, 11 Ref.

Descriptors: *Dredging, *Channel improvement, *Crayfish, Environmental effects, Aquatic habitats, Ware Lock, Lee River, Beane River, *England, Channels, Navigation, Navigation canals.

The impact of river engineering works on fresh water crayfish (Austropotamobius pallipes) was investigated in Hertfordshire in the River Lee and Ware and the River Beane at Hertford. This crustacean, about 9 cm long, is a popular food animal. Construction at the Ware Lock site (1974-76) consisted of channel dredging and installation of sheet pilings, a weir, and weir basin. Sampling in 1979 showed substantial numbers of crayfish in the new weir basin as well as at sites where they were found previously in the lock and lock bypass channel. In the Beane, dredging removed silt and bank plants. Many crayfish were found living among plant roots in a stretch of the river considered unsuitable habitat for these animals. The number of crayfish removed by dredging was reduced 35% by rinsing the dredged material in the river before depositing it on the bank. To encourage colonization and growth of the crayfish populat ions, river engineering works should include installation of rough, creviced material such as broken rocks, to provide desirable habitats. During dredging as many crayfish as possible should be returned to the water from the dredged material. (Cassar-FRC)
W83-00505

THE IMPACT OF DAMMING THE DON RIVER ON THE NATURAL REPRODUCTION OF THE DIADROMOUS SHAD,
Akademiya Nauk URSR, Kiev. Inst. Hidrobiologii.
V. I. Mogil'chenko.
Hydrobiological Journal, Vol 17, No 3, p 105-106, 1981.

Descriptors: *Fish populations, *Dam effects, *River flow, *Shad, Don River, Azov Sea, *USSR, Environmental effects, Fish eggs, Spawning, Salinity, Temperature, Velocity, Water resources development, Water currents.

Damming of the Don River in 1952 reduced shad spawning grounds by half and markedly changed river flow. Compared with the flow before damming, spring flow is less than half, average current velocity in spawning areas is 2-2.5 times less, maximum flow is less than half (1 m per sec), spring water temperatures 1-3C less, and salinity in the Azov Sea is greater. After river regulation the larger variety of the Don shad became dominant over the smaller variety. During low flow years the first 2 batches of eggs are only 50% viable and the third batch is resorbed. Although the shad population has been reduced, the average size and weight have increased. The proportion of females has increased from 33% to 52%. (Cassar-FRC)
W83-00593

POWER INDUSTRY WASTES,
Tennessee Valley Authority, Chattanooga.
For primary bibliographic entry see Field 5G.
W83-00657

7. RESOURCES DATA

7B. Data Acquisition

INSTRUMENTS FOR MOUNTAINOUS AREAS,
Institute of Hydrology, Wallingford (England).
I. Strangeways.
Nordic Hydrology, Vol 12, No 4/5, p 289-296, 1981. 5 Fig, 8 Ref.

Descriptors: *Measuring instruments, *Mountains, *Hydrologic data, *Climatic data, Data acquisition, Basins, Automation, Snow, Ice, Precipitation, Wind, Humidity, Temperature, Radiation, Snowmelt, Weather forecasting, *Scotland.

An automated weather station which measures solar and net radiation, air temperature and humidity, wind speed and direction, and rainfall was developed in 1965 and is presently being used in about 60 locations around the world. The original unit was developed for use in sites having altitudes up to about 600 meters. However, snow and ice problems interfered with reliable operation of the station in the Scottish highlands, rendering the station useless for much of the winter. Alternative techniques for use in mountainous areas are being investigated. The summit of Cairn Gorm in Scotland is being used as a proving ground for experimental methods of preventing ice accretion, new ways of deploying temperature sensors, alternative ways of exposing radiation sensors consistent with the deicing techniques, the use of static sensors for wind measurements, selection of the most appropriate method of sensing humidity, and new ways to measure rain and snowmelt. Although the initial objective was to develop an automated weather station specifically for mountainous climates, the extensive modifications have led to plans to develop a new style, general purpose automated station applicable to a wide variety of climates, including mountainous ones. (Carroll-FRC)
W83-00361

AN AUTOMATIC VOLTAMMETRIC ANALYZER FOR THE SIMULTANEOUS DETERMINATION OF TOXIC TRACE METALS IN WATER,
Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Angewandte Physikalische Chemie.
P. Valenta, L. Sipos, I. Kramer, P. Krumpen, and H. Rutzel.
Fresenius' Zeitschrift fur Analytische Chemie, Vol 312, No 2, p 101-108, 1982. 7 Fig, 4 Tab, 23 Ref.

Descriptors: *Trace metals, *Water analysis, *Automation, *Pollutant identification, Metals, Heavy metals, Control systems, Computers, Cadmium, Lead, Copper, Zinc, Voltammetry.

An automatic voltammetric analyzer for trace metals in water is based on microprocessor technology. It comprises a polarograph with the differential pulse mode, circuitry for automatic adjustment of current sensitivity for each peak, a microprocessor-based controller, a automatic hanging mercury drop electrode, and a printer-plotter. Software consists of 2 independent programs, the parameter input program and the analysis control program. The parameter input program recalls the respective step name and the parameter name. The analysis control program initiates all operations necessary after switching on the power and controls the execution of subsequent steps. This allows adjustment of optimal parameters before every analysis. Subroutines are used to avoid repeating the whole analysis. The printout shows the whole voltammetric curve, energy peaks in an optimal current sensitivity range, and important information about the analysis. Several months of use have shown that performance is very satisfactory. The complete simultaneous determination of Cd, Pb, Cu, and Zn takes 20 min. Accuracy up to 3% can be attained. Detection sensitivity is 0.1 micrograms per liter. (Cassar-FRC)
W83-00510

OBSERVATIONS FROM MOORED CURRENT METERS IN SAN FRANCISCO BAY, 1978.
Geological Survey, Menlo Park, CA. Water Resources Div.
Available from the OFSS, USGS Box 25425, Fed. Ctr. Denver, CO 80225, Price: $8.00 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 82-153, September 1981. 91 p, 2 Fig, 1 Tab, 4 Ref, 3 Append. (Gartner, J.W., and Cheng, R.T., compilers).

Descriptors: *Data collections, *Estuaries, *Current meters, Water currents, Tidal currents, Water temperature, Salinity, *San Francisco Bay, California.

Current-meter data collected at eight stations in the San Francisco Bay estuarine system between August 1978 and December 1978 are compiled in this report. The measurements include current speed and direction, and water temperature and salinity (computed from conductivity and temperature). Data are presented in graphical format with each parameter plotted separately. (USGS)
W83-00551

SPECIFICATION FOR PROCUREMENT OF WATER-LEVEL SENSING INSTRUMENTATION, SPECIFICATION NUMBER HIF-I-1,
Geological Survey, NSTL Station, MS. Water Resources Div.
D. H. Rapp.
Available from the OFSS, USGS Box 25425, Fed. Ctr. Denver, CO 80225, Price: $3.50 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 82-89, January 1982. 24 p, 2 Tab, 3 Ref.

Descriptors: *Measuring instruments, *Specifications, *Classification, *Water level recorders, Design standards, Errors, Testing procedures, Surface water, Gaging station, Water measurement.

This specification is to communicate to instrument manufacturers the U.S. Geological Survey's requirements. It covers systems for sensing the elevation of the water surface on open channels, rivers, lakes, reservoirs, storm-sewer pipes, and observation wells at Survey data-collection sites. The signal output (mechanical or electrical) must meet the signal input requirements of analog to digital and digital input recorders in use by the Survey. A classification of stage-sensing systems by common characteristics is used to aid Survey people making system selections. These characteristics are (1) system type (contact or noncontact), (2) sensor type and sensing distance, (3) accuracy, (4) range, (5) power requirements, (6) system size and weight, and (7) data output signal. Acceptable system requirements cover system configurations, signal outputs, materials, operation manuals, detailed environmental conditions, calibration procedures, system accuracy, power requirements, installation limitations, maintainability, safety, and workmanship. An outline of the qualification test procedures and failure criteria are also given. The Hydrologic Instrumentation Facility at NSTL Station, Mississippi will test available systems to determine if they meet the specification in this report for inclusion in the Survey's 'Qualified Products List'. This list will be used for future procurement of water-level sensing systems by the Survey. (USGS)
W83-00684

ACOUSTIC SYSTEMS FOR THE MEASUREMENT OF STREAMFLOW,
Geological Survey, Portland, OR. Water Resources Div.
A. Laenen, and W. Smith.
Available from the OFSS, USGS Box 25425, Price: $6.75 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 82-329, 1982. 45 p, 19 Fig, 4 Tab, 12 Ref.

Descriptors: *Flowmeters, *Streamflow, *Acoustics, *Flow measurement, Velocity, Electrical equipment, Stream gages, Discharge measurement, Flow rates, *Acoustic velocity meter.

Very little information is available concerning acoustic velocity meter (AVM) operation, performance, and limitations. This report provides a better understanding about the application of AVM instrumentation to streamflow measurment. Operational U.S. Geological Survey systems have proven that AVM equipment is accurate and dependable. AVM equipment has no practical upper limit of measureable velocity if sonic transducers are securely placed and adequately protected, and will measure velocitites as low as 0.1 meter per second which is normally less than the threshold level for mechanical or head-loss meters. In some situations the performance of AVM equipment may be degraded by multipath interference, signal bending, signal attenuation, and variable streamline orientation. Smaller, less-expensive, more conveniently operable microprocessor equipment is now available which should increase use of AVM systems in streamflow applications. (USGS)
W83-00692

7C. Evaluation, Processing and Publication

SNOW SURFACE MEASUREMENTS FROM DIGITAL LANDSAT MSS DATA,
Eidgenoessische Technische Hochschule, Zurich (Switzerland). Inst. for Communication Technology.
J. Lichtenegger, K. Seidel, M. Keller, and H. Haefner.
Nordic Hydrology, Vol 12, No 4/5, p 275-288, 1981. 6 Fig, 3 Tab, 9 Ref.

Descriptors: *Satellite technology, *Snow cover, Mountains, Data acquisition, Remote sensing, Prediction, Runoff, Clouds, *Switzerland, Dischmal-Valley basin, Vorderhein basin.

Snow cover is an important parameter in models used to predict runoff in high mountain areas. Although conventional interpretation methods have been used for some operational applications of satellite data, methods using digital data are not yet fully operational. A new method uses multispectral Landsat data together with a digital terrain model (DTM) to monitor snow cover in various watersheds in a manner which satisfies both the specific requirements of the rugged mountain topography of the Alps and the high accuracy standards of the European user community. This digital interpretation system is designed to provide input data for a runoff model providing a short to medium range water runoff forecast. This technique was used to analyze a watershed encompassing about 1,500 square kilometers. Landsat data were registered to a DTM using a reflectance map. A high correlation was found between the image derived using this method and the real image. The resultant data set for each surface element includes the spectral properties, an elevation zone, an exposure, a slope angle, and a brightness value. The shadowed areas can be detected during the classification process, and radiometric corrections can be made with respect to the incident radiation angle. As a result, snow coverage data within a climatologically similar region can be extrapolated from analysis of a small and representative section of the area involved. Areas partially under cloud cover can be evaluated by this method using data from a small cloud free zone in the area. (Carroll-FRC)
W83-00362

WATER QUALITY MONITORING: WHAT DIRECTIONS SHOULD NEW PROGRAMS TAKE,
Colorado State Univ., Fort Collins. Dept. of Agricultural and Chemical Engineering.
For primary bibliographic entry see Field 5A.
W83-00429

WATER RESOURCES AND ENVIRONMENTAL PLANNING USING INTERACTIVE GRAPHICS,
Cornell Univ., Ithaca, NY.
For primary bibliographic entry see Field 6A.
W83-00456

WATER RESOURCES DATA FOR ARIZONA, WATER YEAR 1980.
Geological Survey, Tucson, AZ. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as Geological Survey Water-Data Report AZ-80-1, February 1982. 568 p, 8 Fig.

Descriptors: *Hydrologic data, *Surface water, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Wells, Water level, Data collections, Sites, Arizona.

Water resources data for the 1980 water year for Arizona consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; water levels of observation wells; and quality of ground water. This report contains discharge records for 240 gaging stations, annual peaks for 61 crest-stage partial-record stations, and discharge measurements at 14 miscellaneous sites; contents only records for 9 lakes and reservoirs; stage and contents for 1 lake, elevation and discharge for 1 streamflow station; elevation only for 1 streamflow station; gage height only for 1 head over a dam; 16 supplementary records, included with gaging-station records, consisting of monthend or monthly stage, contents, and evaporation of lakes and reservoirs, diversions, and return flows; water-quality records for 62 continuous-record stations and 9 miscellaneous sites; water levels for 93 observation wells; and water-quality data for water from 741 wells. The data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating Federal and State agencies in Arizona. (USGS)
W83-00546

WATER RESOURCES DATA FOR WASHINGTON, WATER YEAR 1980--VOLUME 2. EASTERN WASHINGTON.
Geological Survey, Tacoma, WA. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-102707, Price codes: A15 in paper copy, A01 in microfiche. Geological Survey Water-Data Report WA-80-2, 1981. 332 p, 19 Fig.

Descriptors: *Hydrologic data, *Surface water, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Wells, Water level, Data collections, Sites, *Washington, Eastern Washington.

Water resources data for the 1980 water year for Washington consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels and water quality of ground-water wells. This report in two volumes contains records for water discharge at 233 gaging stations, stage only at 5 gaging stations, stage and contents at 41 lakes and reservoirs, and water quality at 39 gaging stations (including 6 lakes and reservoirs) and 100 wells, and water levels at 164 observation wells. Also included are data for 14 crest-stage and 89 water-quality partial-record stations. Additional water data were collected at various sites not involved in the systematic data-collection program and are published as miscellaneous measurements and analyses. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State, local, and Federal agencies in Washington. (USGS)
W83-00547

WATER RESOURCES DATA FOR WASHINGTON, WATER YEAR 1980--VOLUME 1. WESTERN WASHINGTON.
Geological Survey, Tacoma, WA. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-105734, Price codes: A22 in paper copy, A01 in microfiche. Geological Survey Water-Data Report WA-80-1, 1981. 488 p, 22 Fig.

Descriptors: *Hydrologic data, *Surface water, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Wells, Water level, Data collections, Sites, *Washington, Western Washington.

Water resources data for the 1980 water year for Washington consist of records of stage, discharge,

and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels and water quality of ground-water wells. This report in two volumes contains records for water discharge at 233 gaging stations, stage only at 5 gaging stations, stage and contents at 41 lakes and reservoirs, water quality at 39 gaging stations (including 6 lakes and reservoirs) and 100 wells, and water levels at 164 observation wells. Also included are data for 14 crest-stage and 89 water-quality partial-record stations. Additional water data were collected at various siites not involved in the systematic data-collections program and are published as miscellaneous measurements and analyses. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State, local, and Federal agencies in Washington. (USGS)
W83-00548

WATER RESOURCES DATA, NEW YORK, WATER YEAR 1981--VOLUME 1. EASTERN NEW YORK EXCLUDING LONG ISLAND.
Geological Survey, Albany, NY. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-107334, Price codes: A15 in paper copy, A01 in microfiche. Geological Survey Water-Date Report NY-81-1, 1982. 318 p, 5 Fig, 1 Tab.

Descriptors: *Hydrologic data, *Surface water, *Groundwater, *Water quality, Gaging stations, Stream flow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Wells, Water level, Data collections, Sites, *New York, Eastern New York excluding Long Island.

Water resources data for the 1981 water year for New York consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels of ground-water wells. This volume contains records for water discharge at 105 gaging stations, stage only at 6 gaging stations; and stage and contents at 4 gaging stations and 19 other lakes and reservoirs; water quality at 29 gaging stations, 5 precipitation stations and 4 partial-record stations; and water levels at 23 observation wells. Also included are data for 50 crest-stage and 14 low-flow partial-record stations. Additional water data were collected at various sites not involved in the systematic data-collection program and are published as miscellaneous measurements and analyses. These data together with the data in Volumes 2 and 3 represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State, local, and Federal agencies in New York. (USGS)
W83-00549

STATISTICAL SUMMARIES OF WATER-QUALITY DATA FOR TWO COAL AREAS OF JACKSON COUNTY, COLORADO,
Geological Survey, Lakewood, CO. Water Resources Div.
G. Kuhn.
Available from the OFSS, USGS, Box 25425, Fed. Ctr. Denver, CO 80225, Price: $3.50 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 82-121, 1982. 23 p, 3 Fig, 9 Tab, 13 Ref.

Descriptors: *Hydrologic data, *Water quality, *Streams, *Baseline studies, Mathematical studies, Regression analysis, *Colorado, Jackson County, Coalmont, Canadian River.

Statistical summaries of water-quality data are compiled for eight streams in two separate coal areas of Jackson County, Colo. The quality-of-water data were collected from October 1976 to September 1980. For inorganic constituents, the maximum, minimum, and mean concentrations, as well as other statistics are presented; for minor elements, only the maximum, minimum, and mean values are included. Least-squares equations (regressions) are also given relating specific conductance of the streams to the concentration of the major ions. The observed range of specific conductance was 85 to 1,150 micromhos per centimeter for the eight sites. (USGS)
W83-00550

JANUARY 1981 WATER LEVELS, AND DATA RELATED TO WATER-LEVEL CHANGES, WESTERN AND SOUTH-CENTRAL KANSAS,
Geological Survey, Lawrence, KS. Water Resources Div.
M. E. Pabst.
Geological Survey Open-File Report 81-1001, 1981. 168 p, 2 Fig, 1 Tab.

Descriptors: *Groundwater, *Water level, *Hydrologic data, *Water level fluctuations, Observation wells, Irrigation, Groundwater recharge, Aquifers, *Kansas, *Western Kansas, *South-central Kansas.

Water-level measurements were made, mostly in January 1981, in about 1,475 wells in western and south-central Kansas. The measurements were made in mid-winter when pumping was minimal and water levels had recovered, for the most part, from the effects of pumping during the previous irrigation season. Annual hydrologic data are provided for relating water-level changes from a 'base-reference year' (predevelopment year), a year of abnormally high rainfall and minimum pumpage (1966 or 1974), and each of seven consecutive years of measurement (1975-81). The 'base-reference year' is designated as 1940 for the southwestern area, 1944 for the south-central area, and 1950 for the northwestern and west-central areas. Water levels for the 'base-reference year' are established by measurements made during that year and by interpretation of maps showing water-level altitudes. Data also are provided for relating the average annual water-level changes, saturated thicknesses of the deposits, and percentage changes in saturated thicknesses. (USGS)
W83-00553

GEOHYDROLOGY OF THE PREGLACIAL GENESEE VALLEY, MONROE COUNTY, NEW YORK,
Geological Survey, Albany, NY. Water Resources Div.
R. M. Waller, T. J. Holecek, K. I. Mahon, W. G. Stelz, and J. L. Belli.
Available from the OFSS, USGS Box 25425, Fed. Ctr. Denver, CO 80225, Price: $18.00 in paper copy, $2.50 in microfiche. Geological Survey Open-File Report 82-552, 1982. 5 Sheets, 15 Ref.

Descriptors: *Geologic mapping, *Groundwater, *Aquifers, *Groundwater movement, Aquifer characteristics, Well yield, Permeability, Groundwater level, Land use, Geohydrology, Hydrologic data, *New York, Monroe County, Soil permeability.

This report is last in a series of 11 map sets depicting geohydrologic conditions in selected aquifers in upstate New York. Geohydrologic data are compiled on five maps at 1:24,000 scale. Together the maps provide a comprehensive overview of a buried glacio-fluvial aquifer in Monroe County. The maps include surficial geology, geologic sections, bedrock topography, water-infiltration potential of soil zone, potentiometric surface altitude, and land use. The buried-valley deposits consist of ice-contact sand and gravel, till, and glaciolacustrine sand, silt, and clay. The sand and gravel have relatively high permeabilities whereas the till, silt, and clay deposits have relatively low permeabilities. Water-table conditions prevail in unconfined sand and gravel, whereas artesian conditions prevail in the northern part of the system within sand and gravel confined by silty deposits. Recharge occurs principally over the southern part of the aquifer, due to permeable land-surface conditions. Ground-water movement is towards the Irondequoit Bay and Lake Ontario, where discharge occurs. Several communities have wells capable of producing several hundred gallons per minute from the aquifer. The use of land overlying the aquifer is predominantly residential with lesser amounts of industrial uses. (USGS)
W83-00554

GEOHYDROLOGY OF THE VALLEY-FILL AQUIFER IN THE ENDICOTT-JOHNSON CITY AREA, BROOME COUNTY, NEW YORK,
Geological Survey, Albany, NY. Water Resources Div.
T. J. Holecek, A. D. Randall, J. L. Belli, and R. V. Allen.
Available from the OFSS, USGS Box 25425, Fed. Ctr. Denver CO 80225. Price: $18.00 in paper copy, $2.50 in microfiche. Geological Survey Open-File Report 82-268, 1982. 5 Sheets, 5 Ref.

Descriptors: *Geologic mapping, *Groundwater, *Aquifers, *Groundwater movement, Aquifer characteristics, Well yield, Permeability, Groundwater level, Land use, Geohydrology, Hydrologic data, *New York, Broome County, Soil permeability.

This report is the tenth in a series of 11 map sets depicting geohydrologic conditions in selected aquifers in upstate New York. Geohydrologic data are compiled on five maps at 1:24,000 scale. Together, the maps provide a comprehensive overview of a major valley-fill aquifer in southwestern Broome County. The maps include surficial geology, geologic sections, aquifer thickness, water-infiltration potential of soil zone, potentiometric-surface altitude, and land use. The valley-fill deposits consist of alluvial silt and sand, glacial outwash (sand and gravel), ice-contact sand and gravel, till, and lacustrine silt and clay. The sand and gravel beds have relatively high permeabilities whereas the till, silt, and clay deposits have relatively low permeabilities. Water-table conditions are found in unconfined sand and gravel, whereas artesian conditions prevail within sand and gravel confined by silty deposits. Recharge occurs over the entire surface of the aquifer, due to permeable land-surface conditions, but is greatest along the margin of the valley, where runoff from the hillsides is concentrated, and near streams. The use of land overlying the aquifer is predominantly commercial and residential with lesser amounts of agricultural and industrial uses. (USGS)
W83-00555

GEOHYDROLOGY OF THE VALLEY-FILL AQUIFER IN THE RAMAPO AND MAHWAH RIVERS AREA, ROCKLAND COUNTY, NEW YORK,
Geological Survey, Albany, NY.
R. B. Moore, D. H. Cadwell, W. G. Stelz, and J. L. Belli.
Available from the OFSS, USGS Box 25425, Fed. Ctr. Denver, CO 80225. Price: $21.50 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 82-114, 1982. 6 Sheets, 15 Ref.

Descriptors: *Geologic mapping, *Groundwater, *Aquifers, *Groundwater movement, Aquifer characteristics, Well yield, Permeability, Groundwater level, Land use, Geohydrology, Hydrologic data, *New York, Rockland County, Soil permeability.

This report is the eighth in a series of 11 map sets depicting geohydrologic conditions in selected aquifers in upstate New York. Geohydrologic data are compiled on six maps at 1:24,000 scale. Together, the maps provide a comprehensive overview of a major valley-fill aquifer in southeastern Rockland County. The maps include surficial geology, geologic sections, water-infiltration potential of soil zone, aquifer thickness, water-table elevations, well yields, and land use. The valley-fill deposits consists of alluvial silt and sand, glacial outwash (sand and gravel), ice-contact sand and gravel, till, and lacustrine silt and clay. The sand and gravel beds have relatively high permeabilities, whereas the till, silt, and clay deposits have relatively low permeabilities. Water-table conditions prevail in unconfined sand and gravel along the Ramapo River valley and much of the Mahwah River valley. Artesian conditions prevail in confined sand and gravel buried under silt and clay and till in parts of the Mahway valley. The aquifer is recharged throughout, where the land surface is most permeable and is greatest along the margin of the valley, where runoff from the hillsides is concentrated. The use of land overlying the aquifer is

predominantly commercial, agricultural and residential, with lesser industrial uses. (USGS)
W83-00556

BACKGROUND HYDROLOGIC INFORMATION IN POTENTIAL LIGNITE MINING AREAS IN MISSISSIPPI, AUGUST 1980,
Geological Survey, Jackson, MS. Water Resources Div.
J. K. Arthur.
Available from the OFSS, USGS Box 25425, Fed. Ctr. Denver, CO 80225. Price: $2.75 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 81-421, 1981. 19 p, 4 Fig, 4 Tab.

Descriptors: *Hydrologic data, *Water quality, *Lignite, *Streams, Discharge measurement, Water sampling, Bottom sediments, Cross-sections, Low flow, Drainage area, *Mississippi.

The U.S. Geological Survey in cooperation with the Mississippi Bureau of Geology is conducting a hydrologic data collection program in the potential lignite producing areas in Mississippi. During the week of August 25-28, 1980, hydrologic data on channel characteristics were collected at 15 sites on small streams draining potential lignite mining areas in east central Mississippi. Current meter discharge measurements were made and water-quality samples were collected at 11 of the 15 miles. Main channel widths at sampling sites ranged from 126 feet on Sucarnoochee Creek to 15 feet on Houston Creek. Maximum water depth ranged from 7 feet on Pawticfaw Creek and Tallahatta Creek to one-half foot on Okatibbee Creek. The maximum stream discharge measured was 56 cubic feet per second on Pawticfaw Creek. Four sites had no discharge. Specific conductance at sampling sites ranged from 115 micromhos on Ponta Creek to 26 micromhos on Sucarnoochee Creek. The dissolved-oxygen concentration was 5.7 milligrams per liter or higher at all sites. The concentration of suspended sediment was not greater than 38 milligrams per liter at any site. Bottom material samples commonly contained iron, manganese and zinc. (USGS)
W83-00557

SURFACE-WATER AND CLIMATOLOGICAL DATA, SALT LAKE COUNTY, UTAH, WATER YEAR 1980,
Geological Survey, Salt Lake City, UT. Water Resources Div.
G. E. Pyper, R. C. Christensen, D. W. Stephens, H. F. McCormack, and L. S. Conroy.
Geological Survey Open-File Report 81-1111, 1981. 167 p, 1 Plate, 3 Tab, 3 Ref.

Descriptors: *Surface water, *Water quality, *Climatic data, *Data collections, Streamflow, Precipitation, Storm runoff, Chemical analysis, Sediments, *Utah, Salt Lake County.

This report presents streamflow, water-quality, precipitation, and storm-runoff data collected in Salt Lake County, Utah, during the 1980 water year and certain water-quality data for the 1979 water year which were included for comparative purposes. Surface-water data consist of daily mean values of flow at 33 sites on natural streams, canals, and conduits. Water-quality data consist of chemical, biologic, and sediment analyses at 30 sites. Precipitation data consist of daily and monthly total at nine sites. Storm-runoff data consist of 5 and 15-minute interval discharge data for storms of July 1-2, August 19, and August 25, 1980, for most surface-water sites. (USGS)
W83-00559

AN EVALUATION OF WATER-QUALITY MONITORING IN THE BRANDYWINE CREEK BASIN, PENNSYLVANIA, 1973-78,
Geological Survey, Harrisburg, PA. Water Resources Div.
J. J. Murphy, J. R. Ritter, A. E. Brown, and J. P. Chiarella.
Available from the OFSS, USGS Box 25425, Fed. Ctr. Denver, CO 80225. Price: $4.00 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 81-1115, February 1982. 28 p, 10 Fig, 4 Tab, 16 Ref.

Descriptors: *Water quality, *Streams, *Monitoring, *Data collections, Specific conductivity, Dissolved oxygen, Temperature, Hydrogen ion concentration, Streamflow, Water quality standards, *Pennsylvania, Brandywine Creek.

Data recorded from 1973 through 1978 by monitors on West Branch Brandywine Creek at Modena, East Branch Brandywine Creek below Downingtown, and Brandywine Creek at Chadds Ford were analyzed to evaluate the effectiveness of the monitors in describing water-quality conditions. The data show that the stream at Modena and below Downingtown had period of low dissolved oxygen, and that the stream below Downingtown had a particularly severe dissolved-oxygen deficiency from May through September 1974. The pH at all three sites exceeded 9.0 at times and the pH below Downingtown occasionally dropped below 6.0. The most critical period in the basin was from March to November when pH was most likely to exceed water-quality standards and dissolved oxygen was most likely to fall below the standards. Without the monitors, the extent and magnitude of these problems would not have been detected. (USGS)
W83-00560

HYDROLOGY AND CHEMICAL QUALITY OF GROUND WATER IN KIOWA COUNTY, COLORADO,
Geological Survey, Lakewood, CO. Water Resources Div.
M. H. Mustard, and D. Cain.
Available from the OFSS, USGS Box 25425, Fed. Ctr. Denver, CO 80225, Price: $25.25 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 81-1023 (WRI), 1981. 2 Sheets, 26 Ref.

Descriptors: *Groundwater, *Water quality, *Geohydrology, *Aquifers, Aquifer characteristics, Wells, Water level, Groundwater availability, Water use, Water supply, Potential water supply, Chemical analysis, *Colorado, Kiowa County.

Ground water is available in Kiowa County, Colo., in quantities suitable for municipal or irrigation uses from at least two aquifers, the Big Sandy-Rush Creek alluvial aquifer and the Ogallala aquifer. The Dakota Sandstone and the Cheyenne Sandstone Member of the Purgatoire Formation may provide marginally sufficient water for municipal or irrigation purposes. Whil e wells in parts of the Ogallala aquifer have shown significant water-level declines in recent years, the Dakota Sandstone and Cheyenne Sandstone Member of the Purgatoire Formation are virtually undeveloped in the county , primarily because of the depth to the top of these formations (500-1,00 feet). Where water is not available from the Big Sandy-Rush Creek and Ogallala aquifers in the county, supplies sufficient for domestic or stock use may be obtained from shallow wells in several minor aquifers. The quality of ground water in the county varies widely, but dissolved-solids concentrations are usually greater than 500 milligrams per liter, except in parts of the Ogallala aquifer. The water is generally very hard and sulfate concentrations are usually greater than 250 milligrams per liter, except in parts of the Ogallala aquifer. High concentrations of selenium (greater than 10 micrograms per liter) in three-fourths of the wells sampled and locally high concentrations of fluoride, nitrate, iron, and manganese limit the suitability of the ground water for municipal and domestic use. (USGS)
W83-00561

LOW-FLOW CHARACTERISTICS OF OHIO STREAMS,
Geological Survey, Columbus, OH. Water Resources Div.
D. P. Johnson, and K. D. Metzker.
Available from the OFSS, USGS Box 25425, Fed. Ctr. Denver CO. 80225, Price: $37.75 in paper copy, $3.50 in microfiche. Geological Survey Open-Fi le Report 81-1195, 1981. 285 p, 11 Fig, 3 Tab, 15 Ref, 3 Append.

Descriptors: *Streamflow, *Low flow, *Hydrologic data, *Flow characteristics, Streams, Water supply, Waste assimilative capacity, Regulated flow, Base flow, Regression analysis, *Ohio, Stillwater River basin, Great Miami River basin.

Adequacy of streamflow for water supplies or waste water assimilation is commonly evaluated in terms of low-flow characteristics. This report presents annual and seasonal low-flow characteristics for 237 sites on regulated and unregulated streams in Ohio. In addition to compilation of site d ata, two regionalization methods--an analysis of base flow measurements and multiple regression analysis--were applied to test basins to determine the feasibility and accuracy of each me thod. An analysis of base flow measure ments (gain and loss studies) was made on the Stillwater River basin, with error ranging from -39 to 59%. Multiple regression analyses were made on the hydrologic data from the Great Mia mi River basin north of Dayton, which resulted in a standard error of estimate ranging from 110 to 138%. Through the use of an index of relative infiltration, the standard error of estimate was reduced to a range of 33 to 40%. (USGS)
W83-00563

GEOHYDROLOGY OF THE VALLEY-FILL AQUIFER IN THE JAMESTOWN AREA, CHAUTAUQUA COUNTY, NEW YORK,
Geological Survey, Albany, NY. Water Resources Div.
H. R. Anderson, W. G. Stelz, J. L. Belli, and R. V. Allen.
Available from the OFSS, USGS Box 25425, Fed. Ctr. Denver, CO 80225, Price: $18.75 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 82-113, 1982. 7 Sheets, 7 Ref.

Descriptors: *Geologic mapping, *Groundwater, *Aquifers, *Groundwater movement, Aquifer characteristics, Well yield, Permeability, Groundwater level, Land use, Geohydrology, Hydrologic data, *New York, Chautauqua County, Soil permeability.

This report is the sixth in a series of 11 map sets depicting geohydrologic conditions in selected aquifers in upstate New York. Geohydrologic data are compiled on six maps at 1:24,000 scale. Together, the maps provide a comprehensive overview of a major valley-fill aquifer in southeastern Chautauqua County. The maps include surficial geology, geologic sections, water-infiltration potential of soil zone, aquifer thickness, potentiometric-surface elevations and land use. The valley-fill deposits consist of alluvial silt and sand, glacial-outwash (sand and gravel), ice-contact sand and gravel, till, and lacustrine silt and clay. The sand and gravel beds have relatively high permeabilities whereas the till, silt and clay deposits have relatively low permeabilities. Water-table conditions prevail in u nconfined sand and gravel beds along the valley margin. Artesian conditions prevail in confined sand and gravel buried under silt and clay in the middle of the valley. Recharge occurs mainly along the margin of the valley, where the land surface is highly permeable and runoff from the hillsides is concentrated. The use of land overlying the aquifer is predominantly agricultural and residential with lesser amounts of commercial and industrial uses. (USGS)
W83-00564

WATER USE IN THE MISSISSIPPI GULF COAST COUNTIES, 1980,
Geological Survey, Jackson, MS. Water Resources Div.
For primary bibliographic entry see Field 6D.
W83-00680

AVAILABILITY OF WATER FROM AQUIFERS IN UPSTATE NEW YORK,
Geological Survey, Albany, NY. Water Resources Div.
I. H. Kantrowitz, and D. S. Snavely.
Available from the OFSS, USFS Box 25425, Fed. Ctr. Denver, CO 80225, Price: $7.00 in paper copy, $1.00 in microfiche. Geological Survey Open-File Report 82-437, 1982. 2 Sheets, 41 Ref.

Descriptors: *Maps, *Groundwater availability, *Aquifers, *Well yield, Aquifer characteristics, Specific capacity, Groundwater management, New York, *Upstate New York.

Two maps give the locations and estimated yields of unconsolidated and bedrock aquifers of upstate New York, excluding Long Island. The map of surficial deposits give estimates of well yield, aquifer yield, and specific capacity; the map of bedrock units gives the same information and also delineates areas in which induced infiltration from streams into the bedrock and unconsolidated aquifers is possible. The maps are designed to assist planners in managing ground-water supplies. The maps represent data that were compiled in 1969 but not previously published. (USGS)
W83-00681

HYDROLOGIC DATA FROM TEST WELLS AND LOW-FLOW INVESTIGATIONS IN THE MIDDLE REACH OF THE EAGLE RIVER VALLEY, ALASKA, 1980-81,
Geological Survey, Anchorage, AK. Water Resources Div.
G. B. Deeter, and R. S. George.
Available from the OFSS, USGS Box 25425, Fed. Ctr. Denver, CO 80225, Price; $2.00 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 82-362, 1982. 13 p, 5 Fig, 3 Tab, 10 Ref.

Descriptors: *Hydrologic data, *Test wells, *Groundwater potential, *Low flow, Water quality, Potential water supply, Geology, Aquifer characteristics, Groundwater level, Observation wells, Water temperature, Data collections, Sites, Hydrographs, *Alaska, Eagle River valley.

Test wells and low-flow investigations in the Eagle River valley, Alaska, were used to evaluate the feasibility of developing ground water for a public supply. Aquifers capable of supplying large yield wells were not indicated in any of the drilling areas. The data include: results of low-flow seepage investigations at 22 river sites; geologic materials logs of eight test wells; water-quality data from two observation wells, two springs, and two river sites; and water level and temperature information for the observation wells and streams. (USGS)
W83-00682

DATA MANAGEMENT SYSTEM FOR URBAN HYDROLOGY STUDIES PROGRAM,
Geological Survey, NSTL Station, MS. Water Resources Div.
W. H. Doyle, Jr., and J. A. Lorens.
Available from the UFSS, USGS Bo 25425, Fed. Ctr. Denver, CO. 80225, Price: $36.00 in paper copy, $3.50 inmicrofiche. Geological Survey Open-File Report 82-442, 1982. 272 p, 18 Fig, 3 Tab, 6 Ref, 2 Append.

Descriptors: *Data collections, *Data storage and retrival, *Computer models, *Computer programs, Statistical analysis, Data transmission, Urban hydrology, Urban runoff, Storm water, Urban drainage, Rainfall-runoff relationships, Water quality.

A data management system was developed to store, update, and retrieve data collected in urban stormwater studies jointly conducted by the U.S. Geological Survey and U.S. Environmental Protection Agency in 11 cities in the United States. The data management system is used to retrieve and combine data from USGS data files for use in rainfall, runoff, and water-quality models and for data computations such as storm loads. The system is based on the data management aspect of the Statistical Analysis System (SAS) and was used to create all the data files in the data base. SAS is used for storage and retrieval of basin physiography, land-use, and environmental practices inventory data. Also, storm-event water-quality characteristics are stored in the data base. The advantages of using SAS to create and manage a data base are many with a few being that it is simple, easy to use, contains a comprehensive statistical package, and can be used to modify files very easily. Data base system development has progressed rapidly during the last two decades and the data managment system concepts used in this study reflect the advancement made in computer technology during this era. Urban stormwater data is, however, just one application for which the system can be used. (USGS)
W83-00683

GROUND-WATER LEVELS IN SELECTED WELL FIELDS AND IN WEST-CENTRAL FLORIDA, SEPTEMBER 1981,
Geological Survey, Tampa, FL. Water Resources Div.
D. K. Yobbi, and G. L. Barr.
Available from the OFSS, USGS Box 25425, Fed. Ctr. Denver, CO 80225, Price: $7.00 in paper copy, $1.00 in microfiche. Geological Survey Open-File Map 82-261, 1982. 2 Sheets, 2 Ref.

Descriptors: *Potentiometric level, *Groundwater, *Maps, Subsurface water, Aquifers, Water table, Wells, Water level fluctuations, *West-central Floridan aquifer.

The water table in the surficial aquifer and the potentiometric surface of the Floridan aquifer in a 1,200-square-mile area in west-central Florida are mapped semiannually by the U.S. Geological Survey. Maps are based on water levels measured in wells each May to coincide with seasonal low levels and each September to coincide with seasonal high levels. The mapped area shows 14 well fields that supplied 140.3 million gallons to municipalities on September 21, 1981. The water is withdrawn from the Floridan aquifer, the major aquifer in Florida. The effect of localized withdrawal on ground water is shown on the maps as depressions in both the potentiometric and water-table surfaces. In September 1981, ground-water levels were significantly higher than those of May 1981 and were unchanged or within a few feet of those in September 1980. Seasonal recharge from summer rains and reduced pumpage are factors in the water-level recovery from record and near record low levels of May 1981. (USGS)
W83-00685

AQUIFER DATA FROM FOUR WELLS IN THE MENDENHALL VALLEY NEAR JUNEAU, ALASKA,
Geological Survey, Anchorage, AK. Water Resources Div.
G. O. Balding.
Available from the OFSS, USGS Box 25425, Fed. Ctr. Denver, CO 80225, Price: $2.25 in paper copy, $4.00 in microfiche. Geological Survey Open-File Report 82-271, 1982. 14 p, 5 Fig, 6 Tab, 4 Ref.

Descriptors: *Groundwater, *Aquifers, *Data collections, *Water supply, Water quality, Observation wells, Drawdown, Pumping, Drillers logs, Geology, Glacial drift, Chemical analysis, *Alaska, Juneau, Mendenhall Valley.

This report summarizes data collected during drilling and testing of four wells in Mendenhall Valley, an area being developed as a suburb of Juneau, Alaska. Previous studies indicated that the glacial deposits on the east side of the valley had the potential for producing the large quantities of water needed for a community water supply. The drilling defined an upper aquifer between the water table and a depth of 215 feet and a lower aquifer below 252 feet. The testing did not define the storage coefficient or transmissivity of the upper aquifer. Drawdowns within 20 feet of the test well were less than 12 feet when the pumping rate was 300 gallons per minute. Greater pumping rates could be sustained in larger diameter wells having larger screened intervals in the upper aquifer but would produce greater drawdowns. The performance of the lower aquifer was not tested. Water in the upper aquifer is of adequate quality for drinking water, but may require treatment for iron; water from the lower aquifer is brackish. (USGS)
W83-00686

DATA ON SELECTED DEEP WELLS IN SOUTH FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
C. A. Smith, L. Lidz, and F. W. Meyer.
Available from the OFSS, USGS Box 25425, Fed. Ctr. Denver, CO 80225, Price: $19.00 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 82-348, 1982. 144 p, 21 Fig, 4 Tab, 38 Ref.

Descriptors: *Hydrologic data, *Deep wells, *Artesian wells, *Groundwater, Aquifers, Potentiometric level, Water quality, Data storage and retrieval, Well data, Well logs, *Florida, South Florida, Floridan aquifer.

A data base of 870 deep wells was assembled for the south Florida part of the Southeastern Limestone Regional Aquifer Study. The data in this report are for wells in Broward, Collier, Dade, Hendry, Lee, Martin, Monroe, Palm Beach, and St. Lucie Counties. Data are compiled for water wells, oil test wells, injection wells, and monitor wells. These data consist of: (1) well identification and geographic location; (2) well construction and site use; (3) logs available (geologic and geophysical); and (4) selected water-quality parameters. The well locations are shown, by counties, on maps. The number of wells in each county are: Broward, 6; Collier, 237; Dade, 61; Hendry, 130; Lee, 226; Martin, 91; Monroe, 34; Palm Beach, 33; and St. Lucie, 52. Data are stored in the National Water Data Storage and Retrieval system (WATSTORE) in the following files: header, water-quality, and ground-water site inventory (GWSI). (USGS)
W83-00689

FLOOD DATA IN WEST WINDSOR TOWNSHIP, MERCER COUNTY, NEW JERSEY THROUGH 1981 WATER YEAR,
Geological Survey, Trenton, NJ. Water Resources Div.
D. A. Harriman, and A. J. Velnich.
Available from the OFSS, USGS Box 25425, Fed. Ctr. Denver CO 80225, Price: $3.50 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 82-434, May 1982. 22 p, 1 Fig, 2 Tab, 5 Ref.

Descriptors: *Floods, *Flood data, *Flood peak, *Flood discharge, Streamflow, Gaging Stations, Data collections, *New Jersey, Mercer County, West Windsor Township.

Flood stages and peak discharges are described for 13 sites on streams in West Windsor Township, Mercer County, New Jersey, and surrounding areas, collected by the U.S. Geological Survey through the 1981 water year. Included are descriptions and elevations of floodmarks at 30 sites located by the West Windsor Township Environmental Commission after the September 25-27, 1975 flood. (USGS)
W83-00690

BACKGROUND HYDROLOGIC INFORMATION IN POTENTIAL LIGNITE MINING AREAS IN MISSISSIPPI, AUGUST 1981,
Geological Survey, Jackson, MS. Water Resources Div.
J. K. Arthur.
Available from the OFSS, USGS Box 25425, Price: $2.25 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 82-326, 1982. 16 p, 3 Fig, 4 Tab.

Descriptors: *Hydrologic data collections. *Water quality, *Lignite, *Coal mining, Streams, Low flow, Discharge measurement, Water sampling, Sites, Cross sections, Chemical analysis, Suspended sediment, Bottom sediments, Rural areas, *Mississippi.

The U.S. Geological Survey in cooperation with the Mississippi Bureau of Geology is conducting a hydrologic data-collection program in potential lignite-producing areas in Mississippi. During the period August 24-31, 1981, hydrologic data consisting of channel characteristics and stream discharge were collected at 18 sites, and water and channel bottom material samples were collected at 15 sites on small streams draining potential lignite mining areas in east-central Mississippi. Main channel widths ranged from 100 feet on Mill Creek near Louisville to 30 feet on Spring Creek near Bond.

Maximum water depths varied from 12.5 feet on Pawticfaw Creek to 0.2 foot on Beasha Creek. Three sites had no discharge. Specific conductance ranged from 100 micromhos on Lonsilocher Canal near Philadelphia to 24 micromhos on Jofuska Creek near Arlington. Water temperatures varied from 22.5 to 26 degrees Celsius. The highest pH was 7.6 on Fulton and Lonsilocher Canals. The dissolved oxygen concentration was 3.8 milligrams per liter or higher at all sites. Channel bottom-material samples commonly contained iron, manganese, and zinc. (USGS)
W83-00693

GROUND-WATER QUALITY IN EAST-CENTRAL IDAHO VALLEYS,
Geological Survey, Boise, ID. Water Resources Div.
D. J. Parliman.
Available from the OFSS, USGS Box 25425, Fed. Ctr. Denver CO. 80225, Price: $11.50 in paper copy, $5.00 in microfiche. Geological Survey Open-File Report 81-1011, April 1982. 55 p, 9 Fig, 3 Plates, 6 Tab, 32 Ref.

Descriptors: *Groundwater, *Water quality, *Water quality standards, *Data collections, Baseline studies, Aquifers, Groundwater recharge, Groundwater movement, Wells, Well data, Chemical analysis, *Idaho, Lemhi Valley, Pahsimeroi Valley, Salmon River valley, Big Lost River valley, Little Lost River valley.

From May through November 1978, water quality, geologic, and hydrologic data were collected for 108 wells in the Lemhi, Pahsimeroi, Salman River (Stanley to Salmon), Big Lost River, and Little Lost River valleys in east-central Idaho. Data were assembled to define, on a reconnaissance level, water-quality conditions in major aquifers and to develop an understanding of factors that affected conditions in 1978 and could affect future groundwater quality. Water-quality characteristics determined include specific conductance, pH, water temperature, major dissolved cations, major dissolved anions, and coliform bacteria. Concentrations of hardness, nitrite plus nitrate, coliform bacteria, dissolved solids, sulfate, chloride, fluoride, iron, calcium, magnesium, sodium, potassium or bicarbonate exceed public drinking water regulation limits or were anomalously high in some water samples. Highly mineralized ground water probably is due to the natural composition of the aquifers and not to surface contamination. Concentrations of coliform bacteria that exceed public drinking water limits and anomalously high dissolved nitrite-plus-nitrite concentrations are from 15- to 20-year old irrigation wells in heavily irrigated or more densely populated areas of the valleys. Ground-water quality and quantity in most of the study area are sufficient to meet current (1978) population and economic demands. Ground water in all valleys is characterized by significant concentrations of calcium, magnesium, and bicarbonate plus carbonate ions. Variations in the general trend of ground-water composition (especially in the Lemhi Valley) probably are most directly related to variability in aquifer lithology and proximity of sampling site to source of recharge. (USGS)
W83-00694

GEOHYDROLOGY OF THE VALLEY-FILL AQUIFER IN THE ELMIRA AREA, CHEMUNG COUNTY, NEW YORK,
Geological Survey, Albany, NY. Water Resources Div.
T. S. Miller, A. D. Randall, J. L. Belli, and R. V. Allen.
Available from the OFSS, USGS Box 25425, Fed. Ctr. Denver, CO 80225, Price: $25.00 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 82-110, 1982. 7 Sheets.

Descriptors: *Geologic mapping, *Groundwater, *Aquifers, *Groundwater movement, Aquifer characteristics, Well yield, Permeability, Groundwater level, Land use, Geohydrology, Hydrologic data, *New York, Chemung County, Soil permeability.

This report is the third in a series of 11 map sets decpicting hydrogeologic conditions in selected upstate New York aquifers. Geohydrologic data are compiled on seven maps at 1:24,000 scale. Together the maps provide a comprehensive overview of a major valley-fill aquifer in western Chemung County. Included are maps of surficial geology, geologic sections, soil-zone permeability, water-table altitude, aquifer thickness, estimated well yield, and land use. The maps are designed to enable the State to make decisions on waste-disposal plans that could adversely affect the aquifer and community water systems. (USGS)
W83-00695

GEOHYDROLOGY OF THE VALLEY-FILL AQUIFER IN THE CORTLAND-HOMER-PREBLE AREA, CORTLAND AND ONONDAGA COUNTIES, NEW YORK,
Geological Survey, Albany, NY. Water Resources Div.
T. S. Miller, T. D. Brooks, and W. B. Stelz.
Available from the OFSS, USGS Box 25425, Fed. Ctr. Denver, CO 80225, Price: $25.00 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 81-1022, 1981. 7 Sheets.

Descriptors: *Geologic mapping, *Groundwater, *Aquifers, *Groundwater movement, Aquifer characteristics, Well yield, Permeability, Groundwater level, Land use, Geohydrology, Hydrologic data, *New York, Cortland County, Onandaga County, Soil permeability.

This report is the first in a seies of 11 map sets depicting geohydrologic conditions in selected aquifers in upstate New York. Geohydrologic data are compiled on seven maps at 1:24,000 scale. Together, the maps provide the first comprehensive treatment of the principal aquifer in western Cortland County. The set depicts surficial geology, geologic sections, soil permeability, water-table altitude, aqufier thickness, estimated well yield, and land use. The maps are designed to help planners evaluate underground waste-disposal practices. (USGS)
W83-00697

GEOHYDROLOGY OF THE VALLEY-FILL AQUIFER IN THE SPROUT AND FISHKILL CREEKS AREA, DUTCHESS COUNTY, NEW YORK,
Geological Survey, Albany, NY. Water Resources Div.
R. G. LaFleur, and R. B. Moore.
Available from the OFSS, USGS Box 25425, Fed. Ctr. Denver, CO 80225, Price: $21.50 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 82-81, 1982. 6 Sheets, 13 Ref.

Descriptors: *Geologic mapping, *Groundwater, *Aquifers, *Groundwater movement, Aquifer characteristics, Well yield, Permeability, Groundwater level, Land use, Geohydrology, Hydrologic data, *New York, Dutchess County, Soil permeability.

This report is the fifth in a series of 11 map sets depicting geohydrologic conditions in selected aquifers in upstate New York. Geohydrologic data are compiled on six maps at 1:24,000 scale. Together the maps provide a comprehensive overview of a major valley-fill aquifer in southwestern Dutchess County and a small part of Putnan County. The maps include surficial geology, geologic sections, water-infiltration potential of soil zone, aquifer thickness, water-table elevations and land use. The valley-fill deposits consist of alluvial silt and sand, glacial-outwash (sand and gravel), ice-contact sand and gravel, till, and lacustrine silt and clay. The sand and gravel have relatively high permeabilities whereas the till, silt and clay deposits have relatively low permeabilities. Saturated layers of sand and gravel underlie confining layers of silt and clay, and also underlie confining till. The water-infiltration potential of the soil zone of the valley-fill varies widely. Aquifer thickness data is sparse, especially data on the lower confined aquifer layers. Water-table elevations within the surface aquifer are gently sloping, directing ground-water flow towards streams into which discharge occurs. The use of land overlying the aquifer is predominantly agricultural and residential, with lesser amounts of commercial and industrial uses. (USGS)
W83-00698

GEOHYDROLOGY OF THE GLACIOLACUSTRINE AQUIFER IN THE FULTON AREA, OSWEGO COUNTY, NEW YORK,
Geological Survey, Albany, NY. Water Resources Div.
H. R. Anderson, W. G. Stelz, and T. S. Miller.
Available from the OFSS, USGS box 25425, Fed. Ctr. Denver, CO 80225, Price: $18.75 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 82-83, 1982. 7 Sheets, 7 Ref.

Descriptors: *Geologic mapping, *Groundwater, *Aquifers, *Groundwater movement, Aquifer characteristics, Well yield, Permeability, Groundwater level, Land use, Geohydrology, Hydrologic data, *New York, Oswego County, Soil permeability.

This is the second in a series of 11 map sets depicting hydrogeologic conditions in selected upstate aquifers in upstate New York. Geohydrologic data are compiled on seven maps at 1:24,000 scale. Together the maps provide a comprehensive overview of the principal aquifer in western Oswego County. The set includes surficial geology, geologic sections, soil permeability, water-table altitude, aquifer thickness, estimated well yield, and land use. The maps are designed to enable planners to evaluate waste-disposal practices that may adversely affect the aquifer. (USGS)
W83-00699

WATER RESOURCES DATA FOR MARYLAND AND DELAWARE, WATER YEAR 1981.
Geological Survey, Towson, MD. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161. Geological Survey Water-Data Report MD-DE-81-1, 1982. 503 p, 5 Fig, 1 Tab.

Descriptors: *Hydrologic data, *Surface water, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Wells, Water level, Data collections, Sites, *Maryland, *Delaware.

Water resources data for the 1981 water year for Maryland and Delaware consist of records of stage, discharge, and water quality of streams; stage and contents of lakes and reservoirs; and water levels and water quality of ground-water wells. This volume contains records for water discharge at 120 gaging stations, stage and contents at 1 reservoir, water quality at 48 gaging stations and 74 wells, and water levels at 27 observation wells. Also included are data for 13 crest-stage, 62 low-flow, and 4 tidal crest-stage partial-record stations. Additional water data were collected at various sites not involved in the systematic data-collection program and are published as miscellaneous measurements. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State, local, and Federal agencies in Maryland and Delaware. (USGS)
W83-00700

8. ENGINEERING WORKS

8A. Structures

PIPING POTENTIAL OF WEAK ZONES UNDER CONCRETE DAMS,
Bureau of Reclamation, Denver, CO.
G. A. Scott.
Journal of the Geotechnical Engineering Division, Proceedings of the American Society of Civil Engineers, Vol 108, No GT3, p 488-493, March, 1982. 5 Fig, 1 Tab, 5 Ref.

Descriptors: *Concrete dams, *Dam foundation, Dam failure, Foundation failure, Dam stability, Methematical equations, *Piping potential.

Since high exit gradients theoretically exist at the downstream foundation contact of concrete dams, the piping potential of weak zones contacting the foundation in this area should be examined. A method is presented which has been used to evaluate the piping potential of shear zones crossing the foundation of a concrete dam from upstream to downstream. The method, which may also be applied to other conditions, involves determination of the critical exit gradient for the zone in question; determination of the exit gradient for the zone under reservoir conditions; and comparisons of the exit gradient under reservoir conditions to the critical exit gradient. Simple field tests can be used to determine the critical exit gradients for weak zones in concrete dam foundations. Simple calculations considering various depths of treatment concrete used to replace the weak material can be used to determine gradients under reservoir conditions, assuming uniformly isotrophic permeability and two-dimensional flow. The depth of treatment required to provide an appropriate factor of safety against piping can then be determined by comparing the critical exit gradient to calculated gradients for different treatment depths. (Carroll-FRC)
W83-00356

ABNORMAL BEHAVIOUR OF ZEUZIER ARCH-DAM (SWITZERLAND). II. ABNORMAL DAM DEFORMATIONS AND FIRST INVESTIGATIONS ABOUT THEIR ORIGIN,
O. Gicot.
Wasser, Energie, Luft, Vol 74, No 3, p 70-76, 1982. 6 Fig, 3 Ref.

Descriptors: *Deformation, *Dam failure, Arch dams, Concrete dams, Dam foundations, Dam stability, Zeuzier dam, Switzerland, Drainage effects, Tunnel construction, Reservoirs, Foundation rocks, Rocks, Cracks, Monitoring.

Part of a 7-paper series on the deformation of the Zeuzier Dam, Switzerland, this report contains early investigations of the problem. The dam, built in 1954-1957, has the following features: 156 m height, 256 m crest length, 7 m thick at the crest center, 25 m thick at the base center, total volume of 300,000 cu m. Routine monitoring of dam behavior included deflection measurements, temperature measurements of the dam and the air, and drainage and infiltration water flows in certain grouting galleries. Preceding the abnormal events in 1978, deformations had been elastic and drainage and infiltration had been reasonable. Monitoring equipment malfunctions, the exceptionally warm autumn, hysteresis, and earth tremors were ruled out as causes of the rock movements which were discovered in December of 1978. This left only the boring of the Rawil exploration tunnel for a roadway as a probable cause. After tunnel construction was stopped, the deformations stabilized. Analysis of monitoring data indicated that the abnormal movement had begun between September 1976 and September 1978. Inspection in March 1979 revealed opening of vertical joints and cracks in the downstream face, downstream exit galleries, inspection galleries, and dam crest. (Cassar-FRC)
W83-00363

ABNORMAL BEHAVIOUR OF ZEUZIER ARCH-DAM (SWITZERLAND), III. GEODETIC DEFORMATION MEASUREMENTS,
Schneider (Walter) Ltd., Chur (Switzerland).
K. Egger.
Wasser, Energie, Luft, Vol 74, No 3, p 76-80, 1982. 7 Fig, 4 Ref.

Descriptors: *Deformation, *Dam failure, *Measuring instruments, *Monitoring, Arch dams, *Concrete dams, Dam foundations, Dam stability, Reservoirs, Zeuzier Dam, Switzerland, Cracks, Stress analysis, Geodetic measurements.

Deformation measurements are the subject of this part of a 7-paper series on deformation of the Zeuzier arch dam, Switzerland. Geodetic measurements, a triangulation scheme downstream of the dam, showed little horizontal or vertical displacement of the dam between 1961 and 1976 (8 observations). The 1979 measurements indicated horizontal movement of all pillars in the observation network, a maximum of 71 mm upstream at the crest center. Vertical displacements reached 83 mm at the dam and less toward the valley slopes. A new geodetic scheme was designed to overcome the deficiencies of the old scheme, which did not cover a sufficiently large area and was unusable in winter. Additional pillars were erected upstream and downstream and a MeKometer ME 3000 distance measuring instrument installed. Preci se transverses installed in the control galleries were connected to the triangulation scheme. The new scheme also permitted measurements in individual sectors. Measurements made since 1979 indicate that movement has stopped. (Cassar-FRC)
W83-00364

ABNORMAL BEHAVIOUR OF ZEUZIER ARCH-DAM (SWITZERLAND), IV. GEOLOGICAL ASPECTS OF THE EXTRAORDINARY BEHAVIOUR OF ZEUZIER ARCH DAM,
T. R. Schneider.
Wasser, Energie, Luft, Vol 74, No 3, p 81-94, 1982. 10 Fig.

Descriptors: *Deformation, *Dam failure, Geology, Geohydrology, Seismic properties, Karst, Groundwater movement, Arch dams, Concrete dams, Dam foundations, Dam stability, *Zeuzier Dam, *Switzerland, Reservoirs, Monitoring, Tunnel construction, Drainage effects, Cracks, Arch dams.

The geological aspects of the Zeuzier arch dam are described as part of a series of 7 papers on deformation of this dam. The dam and reservoir are situated in the Helvetic nappe system of the Swiss Alps. The nappe is cut by several internal overthrusts and faults and exhibits some internal folding. Cycles of competent calcareous formations and incompetent marly formations alternate. The dam foundation rocks are Malm limestones surrounded by massive schist formations. The calcareous rocks are permeable, the marly series is rather impervious. Two groundwater systems exist. In the upper Malm limestones surface water circulates along fractures in a minor karst formation. The lower parts of the Malm limestones contain groundwater under pressure, with strong flows in summer and reduced flows in winter. Detailed instrumental, borehole, and water chemistry investigations revealed that the foundation rock was still in good condition and of low permeability and the grout curtain was intact. Evidence is presented to show that drilling the exploratory road tunnel was the cause of the rock deformations. The rock settlement corresponds with settlements due to lowering of groundwater table in soils. There is a geologic connection between the two, about 1400 m. The strongest deformation corresponded with the greatest drainage flows in the tunnel and with seasonal decreases in groundwater flow. Water chemistry indicated that water was draining from the lower groundwater system. Microseismic activity was detected shortly after the first major water inflow into the tunnel in September 1978. (Cassar-FRC)
W83-00365

ABNORMAL BEHAVIOUR OF ZEUZIER ARCH-DAM (SWITZERLAND) V. EXAMINATION OF CONDITION AND EVALUATION OF REPAIR METHODS,
Suiselectra Consulting Engineers, Basel (Switzerland).
A. R. Berchten.
Wasser, Energie, Luft, Vol 74, No 3, p 94-102, 1982. 10 Fig, 3 Tab.

Descriptors: *Deformation, *Dam failure, *Concrete technology, Arch dams, Concrete dams, Dam foundations, Dam stability, Zeuzier Dam, Switzerland, Reservoirs, Rehabilitation, Resins, Grouting, Cracks, Monitoring.

Examination of the condition on the Zeuzier arch dam, Switzerland, and evaluation of repair methods were considered in this paper, part of a series of 7 papers. The investigation was divided into 3 zones of interest: the grout curtain, the abutment (concrete-rock contact) and the dam body. Boreholes drilled into the grout curtain and water pressure tests revealed that the grout curtain was functional, the banks along the dam were impervious except at existing faults, the rock quality was good, and no new faults were detected. Similar tests on the abutment zone indicated that the cement-rock contact had been broken in places but was repairable. Lateral compression caused cracks in the dam body, starting at both extremities of the crest, extending down diagonally to near the base of the concrete, and then horizontally across the dam face near the bottom. Vertical joints also opened on the upstream face. Crack widths were a maximum of 15 mm, 4-7 mm in sections with parallel cracks, and < 5 mm in inspection galleries. Test cracks wider than 0.5 mm were repaired by injecting Rodur 510 and 512, epoxy resin based low and high viscosity materials. Tests on repaired c racks showed excellent bonding between injected epoxide and concrete. (Cassar-FRC)
W83-00366

ABNORMAL BEHAVIOUR OF ZEUZIER ARCH-DAM (SWITZERLAND) VI. STATIC CALCULATIONS,
W. Amberg, and G. Lombardi.
Wasser, Energie, Luft, Vol 74, No 3, p 102-109, 1982. 10 Fig, 1 Tab.

Descriptors: *Deformation, *Dam failure, Stress analysis, Arch dams, Dam foundations, Dam stability, Zeuzier Dam, Switzerland, Rehabilitation, Cracks, Concrete dams, Monitoring.

Three separate static calculation s were performed for the Zeuzier arch dam, Switzerland, in connection with its construction in 1954, the deformation observed in 1978-79, and repair plans. The findings are part of a 7-part report. The dam was deemed repairable if further deformations did not exceed 20% of previous movement. This decision was based on the excellent quality of the concrete, the confined nature of the highest stresses, the stress reduction caused by refilling, and the good quality of crack repair possible. Simulation analysis of the deformation on a cantilever in the central part of the wall showed the mechanism of the deflection of the top to the upstream side and the cracking. (Cassar-FRC)
W83-00367

ABNORMAL BEHAVIOUR OF ZEUZIER ARCH-DAM (SWITZERLAND) VII. PROGRAMS FOR REFILLING AND MONITORING,
Eidgenoessisches Amt fuer Wasserwirtschaft, Bern (Switzerland).
R. Biedermann.
Wasser, Energie, Luft, Vol 74, No 3, p 110-112, 1982. 2 Fig.

Descriptors: *Dam failure, *Deformation, *Monitoring, Reservoirs, Dam stability, Arch dams, Concrete dams, Stress analysis, Measuring instruments, Rehabilitation, Dam foundations, Cracks, Zeuzier Dam, Switzerland.

Refilling of the reservoir behind the Zeuzier arch dam, Switzerland, after crack repairs is described in the last of 7 papers on the deformation and repair of this structure. Four annual refilling stages have been selected: 1720, 1750, 1765, and 1777 m above sea level. The last value corresponds to the normal operating level. The water level will be kept at least 20 m below completed repair work, with increasing discharge in case of flood. The monitoring system includes water level recorder, thermometers, pendulums, a geodesic network, extensometers, rock meters, slope indicators, shear strips, groundwater inflow measuring stations, manometers, seismographs, and flow gaging stations for springs. The monitoring regime for each of the 4 filling cycles is divided into: new phase, drawdown phase in winter, and the refilling to previous level phase. (Cassar-FRC)
W83-00368

ABNORMAL BEHAVIOR OF ZEUZIER ARCH-DAM (SWITZERLAND) I. GENERAL VIEW,
Eidgenoessisches Amt fuer Wasser irtschaft, Bern (Switzerland).
R. Biedermann.

Wasser, Energie, Luft, Vol 74, No 3, p 65-70, 1982. 5 Fig.

Descriptors: *Deformation, *Dam failure, Arch dams, Concrete dams, Dam foundations, Dam stability, Zeuzier Dam, *Switzerland, Drainage effects, Reservoirs, Tunnel construction, Foundation rocks, Rocks, Monitoring, Cracks.

A general overview is presented, part of a 7-paper series, of the deformation problem of the 156 m high Zeuzier arch dam, Switzerland. In November 1978, after 21 years of normal operation, an upstream movement of the dam crest was monitored although the reservoir was nearly full. Neither temperature changes nor defects in the monitoring system were at fault so the water level was lowered to a minimum and a nearby road tunnel construction project was stopped. Subsequent investigations revealed that an extended homogeneous rock settlement was occurring. This caused dam settlement, a narrowing of the gorge, and a rotation of the rock found in the downstream direction. Movements increased until April 1979 and slowly declined thereafter. About 90% of expected movement has already taken place. As of the end of 1981 the dam had settled 11 cm and the upstream displacement of the crest was 11 cm. It was concluded that rock deformation had been caused by drainage effects of the exploratory tunnel. The dam is considered repairable if further settlement can be prevented. This situation forces a choice between repairing the dam and continuing the alpine road tunnel. Refilling is planned for 4 annual steps. This incident demonstrates the advantages of continuous monitoring for early detection of deformation. (Cassar-FRC)
W83-00508

PENSTOCK ENTRANCE RESEARCH-AUBURN DAM ENTRANCE,
Bureau of Reclamation, Denver, CO. Engineering and Research Center.
C. A. Pugh.
Bureau of Reclamation Report GR-828, August 1982. 22 p, 13 Fig, 1 Tab, 2 Ref.

Descriptors: *Penstocks, *Dam design, *Hydraulic design, *Hydraulic models, *Trash racks, Hydroelectric plants, Intakes, Model studies, Head loss, Design criteria.

In order to extend earlier value engineering concepts on the design of penstock entrances to dams with sloping faces and inclined penstocks, a penstock entrance design was developed for the Auburn Dam. A model of the Auburn Dam entrance was constructed on a 1:15.74 scale. The model included the penstock entrance, trashrack seat, circular-to-rectangular transition, and a 4.57-m prototype diameter penstock. The Auburn Dam penstock entrance design had excellent hydraulic characteristics. The design had low intake losses and acceptable pressures along the intake surfaces. The semicircular trashrack seat in front of the intake had a positive effect in reducing intake head losses and pressure drops along the intake surfaces. The compound radius bottom curve of the penstock entrance was very important in reducing losses in the inclined penstock. The results from this study in combination with earlier results from the Grand Coulee Third Powerplant model study can be used in the design of other low-velocity conduit and penstock entrances for dams having vertical faces and horizontal penstocks or sloping faces and inclined penstocks. (Moore-SRC)
W83-00638

8B. Hydraulics

BOUNDARY INTEGRAL SOLUTIONS OF WATER WAVE PROBLEMS,
Lehigh University, Bethlehem, PA. Dept. of Civil Engineering.
G. P. Lennon, P. L.-F. Liu, and J. A. Liggett.
Journal of the Hydraulics Division, Proceedings of the American Society of Civil Engineers, Vol 108, No HY8, p 921-931, August, 1982. 8 Fig, 9 Ref.

Descriptors: *Waves, *Tsunamis, Wave progagation, *Boundary Integral Equation Method, Sea bed, Seismic waves, Tidal waves, Numerical analysis, Submerged beds.

The Boundary Integral Equation Method is applied to three-dimensional, lineraized, transient water wave problems. This paper considers only the radiation problems concerning long waves (tsunamis) generated by an upthrust block of sea bed. Free-surface boundary conditions are applied to the still water level rather than the actual location of the free surface, forming a fixed boundary problem. A radiation boundary condition is used to truncate the computational domain. Solutions are given for 3 sample problems using a 4 ft x 8 ft upthrust block and different speeds of block motion: fast, transitional, and very slow (creeping). The numerical results obtained in this study agree reasonably well with previous analytical solutions. (Cassar-FRC)
W83-00463

CONVECTIVE RESPONSE OF A MASS OF WATER NEAR 4 C TO A CONSTANT COOLING RATE APPLIED ON ITS BOUNDARIES,
Montreal Univ. (Quebec). Dept. of Civil Engineering.
L. Robillard, and P. Vasseur.
Journal of Fluid Mechanics, Vol 118, p 123-141, 1982. 9 Fig, 22 Ref.

Descriptors: *Convection, *Cooling, Fluid mechanics, Rayleigh number, Water properties, Water cooling, Water circulation, Water temperature, Temperature, *Boundary conditions.

The convection of a mass of water confined in a closed cavity with a steadily decreasing wall temperature is considered through a dimensional analysis based on the assumption of a linear relationship between the thermal expansion coefficient and temperature. A quasi-steady state (constant velocity, flow pattern, and temperature difference between fluid and wall) can be reached provided that the cooling rate of the wall is constant for a sufficient period. The steady-state flow characteristics in the case of a specific geometry are functions of the Rayleigh number which uses a dimensionless temperature based on the cooling rate. For the case of water cooled through 3.98C, at which maximum density is observed, there is a linear relationship between the water thermal expansion coefficient and temperature and the cooling process, characterized by the Rayleigh number. Convective motion decreases as water is cooled toward 3.98C, at which it reverses and increases. Numerical results are given for the case of a square cavity. Experimental and numerical results are discussed for the case of a horizontal circular pipe. (Cassar-FRC)
W83-00512

A FOURIER METHOD FOR SOLVING NONLINEAR WATER-WAVE PROBLEMS: APPLICATION TO SOLITARY-WAVE INTERACTIONS,
New South Wales University, Kensington (Australia). School of Mathematics.
J. D. Fenton, and M. M. Rienecker.
Journal of Fluid Mechanics, Vol 118, p 411-443, 1982. 14 Fig, 4 Tab, 18 Ref.

Descriptors: *Wave propagation, *Fourier analysis, *Solitary waves, Wave pile-up, Fluid mechanics, Wave height.

A numerical method for solution of full nonlinear equations governing irrotational flow with a free surface and variable bed topography was applied to unsteady motion of nonbreaking waves over a horizontal bed. A truncated Fourier series and the finite difference method approximated the horizontal variation and the time variation, respectively. Study of the interaction of one solitary wave overtaking another showed that the Korteweg-deVries equation was applicable here because waves were long and low. One deviation from the theoretical was the significant growth of the overtaking high wave at the expense of the low wave. A mechanism was suggested to explain the observed forward phase shift of the high wave in wave interactions where the high, rear wave exchanges identities with the low, front wave before they have completely coalesced. The Fourier method also was used to study solitary waves traveling in opposite directions. Here there was a change of wave height and propagation speed proportional to the cube of the initial wave height but not contained in third-order theoretical results. With a solitary wave reflected by a wall the third-order theory was excellent for the maximum run-up at the wall but in error in the phase change of the wave after reflection. (Cassar-FRC)
W83-00514

THE DRIFT VELOCITY OF WATER WAVES,
Saint Andrews Univ. (Scotland). Dept. of Applied Mathematics.
A. D. D. Craik.
Journal of Fluid Mechanics, Vol 116, p 187-205, 1982. 31 Ref.

Descriptors: *Wave velocity, Fluid mechanics, Contamination, Physical properties, Viscosity, Water properties, Water currents, Drift.

Surface contamination of water, such as that caused by a surfactant, is shown to greatly enhance the drift velocity of short water waves. An initial value problem for drift current associated with temporally decaying waves is solved. The results resolve questions raised by the work of Liu and Davis, 1977. Calculation of the steady drift velocity of spatially decaying waves shows that it closely resembles the Longuet-Higgins conduction solution for unattenuated waves. It is also established that unidirectional drift currents of both surface and interfacial waves are unstable to spanwise periodic disturbances. (Cassar-FRC)
W83-00515

FLOW BENEATH A STAGNANT FILM ON WATER: THE REYNOLDS RIDGE,
Essex Univ., Colchester (England). Fluid Mechanics Research Inst.
J. C. Scott.
Journal of Fluid Mechanics, Vol 116, p 283-296, 1982. 6 Fig, 28 Ref.

Descriptors: *Surface flow, *Flow patterns, *Films, *Reynolds ridge, *Fluid mechanics, Ridges, Barriers, Surfactants, Organic matter, Streamflow, Compressibility, Flow velocity, Boundary layers, Turbulent flow, Stagnant water, Contamination.

The Reynolds ridge is a phenomenon observed in water-surface flow in nature and in the laboratory. This surface distortion, usually a barely discernible ridge, is formed when naturally-occurring organic surface active material both reduces the surface tension and imparts elastic properties to the surface, enabling it to resist compression. When this surface layer is trapped and compressed against a fixed shallow-draft object (for example, a twig in a stream) the surface becomes incompressible. The flow beneath the barrier forms a viscous boundary layer under the surface film, producing a distortion upstream of the obstruction. The ridge marks the boundary between regions of greater and lesser calm. The film-covered region near the obstruction suppresses the wind- and turbulent flow-excited surface disturbances more than the freely moving region does. Results of experimental measurements of the ridges in a flow channel apparatus agreed well with those predicted by a theoretical model (Harper and Dixon, 1974). Agreement was best at the highest flow velocities. At very low flow velocities the measured peak-slope difference was less than predicted. (Cassar-FRC)
W83-00516

8E. Rock Mechanics and Geology

REMEDIAL TREATMENT EXPLORATION, WOLF CREEK DAM, KY,
Army Engineer District, Nashville, TN.
M. D. Simmons.
Journal of the Geotechnical Engineering Division, Proceedings of the American Society of Civil En-

gineers, Vol 108, No GT7, p 966-981, July, 1982. 3 Tab, 8 Fig, 11 Ref.

Descriptors: *Dams, *Earthworks, *Karst, *Sinks, Grouting, Reservoirs, Design criteria, Seepage, Earth dams, Closed basins, Gravity dams, Limestone, Costs, Construction costs, Embankments, *Kentucky, Wolf Creek dam, *Underseepage, *Piping phenomena.

Remedial treatments to solve underseepage and piping problems related to the karstic foundation of Wolf Creek dam in Kentucky are described. Various exploratory techniques were used to assess the source of problems caused by development of a sinkhole at the downstream toe of the earth embankment. Direct subsurface information obtained from drilling and grouting was the most reliable. Following emergency grouting, a concrete diaphragm wall through the dam into the limestone foundation was chosen to correct the problem. Such a solution had never previously been attempted ahead of schedule, under bid price, and with no major problems during construction. Advantages to this procedure included the following: as holes were drilled and systematically backfilled, any voids in the embankment or foundation were immediately filled, and subsurface information was available to establish limits of the wall throughout the repair. (Titus-FRC)
W83-00651

8F. Concrete

PIPING POTENTIAL OF WEAK ZONES UNDER CONCRETE DAMS,
Bureau of Reclamation, Denver, CO.
For primary bibliographic entry see Field 8A.
W83-00356

8G. Materials

THE CONSTRUCTION OF THE MARCHWIEL RESERVOIR USING A HIGH DENSITY POLYETHYLENE LINING,
Wrexham and East Denbighshire Water Co. (England).
B. P. Reynolds, B. Bellis, and P. Reddington.
Journal of the Institution of Water Engineers and Scientists, Vol 36, No 3, p 234-238, May, 1982.

Descriptors: *Reservoir lining, *Plastics, *Polyethylene, Reservoir construction, Marchwiel Reservoir, *Wales, Linings, Sealants.

A high density polyethylene lining was installed at the Marchwiel Reservoir in Wales after site investigations showed that the proposed reservoir floor coincided with a brown silty clay strata. Clay suitable for sealing was not available on site. The poly ethylene sheeting was obtained in 10 m wide, 150 m long rolls. The plastic sheets were installed with a 150 mm overlap and sealed together by molten plastic of the same type. After reservoir filling, leakage was noted and was traced to 4 tiny defects in the seam welds. Stone-filled gabions were placed on the uppermost part of the slope to protect the plastic sheeting from sunlight, vandalism, and boats and to provide a surface for climbing out in case a person should fall into the water. (Cassar-FRC)
W83-00504

INSTALLATION OF FLEXIBLE MEMBRANE LINING IN MT. ELBERT FOREBAY RESERVOIR,
Bureau of Reclamation, Denver, CO. Applied Sciences Branch.
W. R. Morrison, E. W. Gray, Jr., D. B. Paul, and R. K. Frobel.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-265356, Price codes: A04 in paper copy, A01 in microfiche. Bureau of Reclamation Report REC-ERC-82-2, September 1981. 51 p, 48 Fig, 5 Tab, 6 Ref.

Descriptors: *Reservoir linings, *Membrane linings, *Forebays, *Seepage control, Linings, Pumped storage, Quality control, Inspection, Installation, Reservoir construction.

During the summer of 1980, approximately 117 ha of 1.14-mm CPER (reinforced chlorinated polyethylene) flexible membrane lining was installed in the Mt. Elbert Forebay Reservoir. The forebay reservoir and the Mt. Elbert Pumped-Storage Powerplant are part of the East Slope Power System of the Fryingpan-Arkansas Project. The installation constitutes the world's largest single-cell flexible membrane lining application to date, and is the first time that such a material has been used in a pumped-storage reservoir for seepage control. To meet the requirement for power online for the powerplant by July 15, 1981, the installation had to be accomplished in one construction season. Efficient handling and processing of earth materials were the keys to completing the job on schedule. The QA (Quality Assurance) Program was very effective. Probably the most valuable part of the QA Program was the field inspections, both factory and jobsite. The seam peel strength test for factory and field seams provided important information as to seam quality. Air lance testing proved to be a quick and effective method for checking the bonded overlap of seams. Field cutout samples proved to be a good check on the quality of the field seams. (Moore-SRC)
W83-00641

8I. Fisheries Engineering

AN ANALYSIS OF MESH SIZES REQUIRED FOR SCREENING FISHES AT WATER INTAKES,
Central Electricity Generating Board Southampton (England). Marine Biological Lab.
A. W. H. Turnpenny.
Estuaries, Vol 4, No 4, p 363-368, December, 1981. 3 Fig, 2 Tab, 4 Ref.

Descriptors: *Intakes, *Fish barriers, *Screens, *Mesh size, Powerplants, Cooling water, Mathematical equations, Estimating equations.

Twenty-four species of marine and fresh water fish were measured to determine optimal mesh sizes for fish screens. Samples were collected from cooling water intakes of power stations on the south coast of England, from trawlers, and from a hatchery. Curves relating fish length to mesh size requirements as a function of fish shape and size are given. A model for predicting mesh size requirements as a function of fish shape and size proved more accurate (7.3% mean deviation) than the Bell (1973) model (45% mean deviation). For species not included in the curves, the screen mesh size requirements can be estimated from an equation. (Cassar-FRC)
W83-00450

AN APPLIED COUPLED SIMULATION-OPTIMIZATION MODEL OF WATER USE EFFICIENCY IN INTENSIVE FISH CULTURE SYSTEMS,
Idaho Univ., Moscow. Dept. of Fishery Resources.
G. W. Klontz.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-125203, Price codes: A05 in paper copy, A01 in microfiche. Completion Report, Idaho Water and Energy Resources Research Institute, Idah University, Moscow, March 1982. 91 p, 5 Fig, 3 Tab, 111 Ref. OWRT A-063-IDA(1), 14-34-0001-0114.

Descriptors: *Water use efficiency, *Simulation analysis, *Computer models, Aquaculture, *Fish management, Trout, Mathematical studies, Optimization, Systems analysis, Model studies, Mathematical models, Fish farming, Aquatic life, Fisheries, Fish populations, *Idaho.

A bioenergetics modeling approach is presented which links the quantitative effects of the biotic and abiotic dependencies of aquaculture systems operation which impact on the allowable growth rate of the fish. The reported computer-implemented mathematical model addresses one of the significant aquaculture systems management limitations, that of production forecasting. The model predicts allowable growth rates and systems production. The conceptual framework of the model is not only applicable to the fish species (rainbow trout) from which it was developed, but is applicable to all aquaculture systems. Reparameterization of specific components results in valid models for other species. In order to develop the computerized systems model, it was necessary to identify the qualitative and quantitative interrelationships among major aquaculture system variables and to construct a quantitative model reflecting these interrelationships. Considered are: water characteristics, pond design, nutrition, waste products, feeding rates, and fish growth and activity. Use of the model in aquaculture operations for production forecasting would enhance operational efficiency and profit. Various applications of the model are discussed. (Zielinski-MAXIMA)
W83-00617

10. SCIENTIFIC AND TECHNICAL INFORMATION

10F. Preparation Of Reviews

EUTROPHICATION,
Colorado Univ., Boulder.
For primary bibliographic entry see Field 5C.
W83-00477

MIXING AND TRANSPORT,
Georgia Inst. of Tech., Atlanta. School of Civil Engineering.
For primary bibliographic entry see Field 5B.
W83-00478

NON-POINT SOURCES,
Browne (F. X.) Associates, Inc., Lansdale, PA.
For primary bibliographic entry see Field 5B.
W83-00479

DENITRIFICATION,
Metropolitan Sanitary District of Greater Chicago, IL.
For primary bibliographic entry see Field 5D.
W83-00480

OPERATION AND MAINTENANCE OF WASTEWATER SYSTEMS INCLUDING INSTRUMENTATION AND AUTOMATION,
Lehigh Univ., Bethlehem, PA. Center for Marine and Environmental Studies.
For primary bibliographic entry see Field 5D.
W83-00481

ONSITE ALTERNATIVES FOR TREATMENT AND DISPOSAL,
Wisconsin Univ.-Madison.
For primary bibliographic entry see Field 5D.
W83-00482

SLUDGE TREATMENT, UTILIZATION, AND DISPOSAL,
Duke Univ. Durham, Dept. of Civil Engineering.
For primary bibliographic entry see Field 5E.
W83-00483

BIOLOGICAL FILTERS,
Massachusetts Univ., Amherst. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5D.
W83-00484

LAGOONS AND OXIDATION PONDS,
Lubbock Christian Coll., TX. Inst. of Water Research.
For primary bibliographic entry see Field 5D.
W83-00485

PHYSICAL AND CHEMICAL METHODS,

Florida Univ., Gainesville. Dept. of Environment Engineering Sciences.
For primary bibliographic entry see Field 5D.
W83-00486

DISINFECTION,
Illinois Inst. of Tech., Chicago. Pritzker Dept. of Environmental Engineering.
For primary bibliographic entry see Field 5F.
W83-00487

CONTINUOUS MONITORING, AUTOMATED ANALYSIS, AND SAMPLING PROCEDURES,
Oak Ridge National Lab., TN.
For primary bibliographic entry see Field 5A.
W83-00488

MICROBIOLOGY OF POTABLE WATER AND GROUND WATER,
Environmental Protection Agency, Dallas, TX. Region VI.
For primary bibliographic entry see Field 5F.
W83-00655

POWER INDUSTRY WASTES,
Tennessee Valley Authority, Chattanooga.
For primary bibliographic entry see Field 5G.
W83-00657

MICROBIOLOGY: DETECTION OF BACTERIAL PATHOGENS AND THEIR OCCURRENCE,
Environmental Protection Agency, Cincinnati, OH. Drinking Water Research Div.
For primary bibliographic entry see Field 5A.
W83-00658

SUBJECT INDEX

2

Effects of 2,4-D on Non-Target Species in Kerr Reservoir,
W83-00378 3B

ACCUMULATION
Effect of EDTA on Cadmium in Activated Sludge Systems,
W83-00489 5D

ACID RAIN
National Acid Precipitation Assessment Plan.
W83-00607 5G

ACIDS
Anaerobic Treatment of an Industrial Wastewater Containing Acetic Acid, Furfural, and Sulphite,
W83-00587 5D

ACOUSTIC VELOCITY METER
Acoustic Systems for the Measurement of Streamflow,
W83-00692 7B

ACOUSTICS
Acoustic Systems for the Measurement of Streamflow,
W83-00692 7B

ACRYLAMIDE
Rapid Screening Technique Utilising High-Performance Liquid Chromatography for Assessing Acrylamide Contamination in Effluents,
W83-00381 5A

ACTIVATED SLUDGE PROCESS
Fate and Distribution of a Quaternary Ammonium Surfactant, Octadecyltrimethylammonium Chloride (OTAC), in Wastewater Treatment,
W83-00433 5D

First Impressions of a Novel Aeration System for Activated Sludge Plants,
W83-00475 5D

A Comparison of the Carrousel and Pasveer Ditch Activated Sludge Plant,
W83-00476 5D

New Sludge System Reduces Landfilling Needs at Weyerhaeuser.
W83-00586 5D

The Effect of Water Hardness on Nitrilotriacetate Removal and Microbial Acclimation in Activated Sludge,
W83-00668 5D

Use of a Kinetic Study to Optimize the Activated Sludge Process,
W83-00677 5D

ADAPTATION
Ecological Consequences of Long-Term Exposure of Anabaena Variabilis (Cyanophyceae) to Shifts in Environmental Factors,
W83-00391 5C

The Influence of Sulphite Mill Effluents on Heterotrophic Activity as Measured by Glucose Assimilation,
W83-00536 5C

ADJUDICATION PROCEDURE
Adjudicatory Hearings as Part of the NPDES Hearing Process,
W83-00424 6E

ADSORBENTS
Cation-Exchange Behaviour of a Range of Adsorbents and Chromatographic Supports With Regard to Their Suitability for Investigating Trace Metal S peciation in Natural Waters,
W83-00517 5A

ADSORPTION
Desorption of Ru106, Cs134, Cs137, Ce144 and Am241 From Intertidal Sediment Contaminated by Nuclear Fuel Reprocessing Effluents,
W83-00437 5B

AERATION
First Impressions of a Novel Aeration System for Activated Sludge Plants,
W83-00475 5D

A Comparison of the Carrousel and Pasveer Ditch Activated Sludge Plant,
W83-00476 5D

Winter Microbial Activity in Lake Tuusulanjarvi,
W83-00528 5G

AERATION TANKS
Comparative Evaluation of Mathematic Models Used for Calculating Aeration Tanks,
W83-00672 5D

AEROBIC TREATMENT
The Theory and Design of Aerobic Biological Treatment,
W83-00413 5D

AGRICULTURE
Agriculture,
W83-00540 3F

AIR POLLUTION
National Acid Precipitation Assessment Plan.
W83-00607 5G

ALASKA
Hydrologic Data From Test Wells and Low-Flow Investigations in the Middle Reach of the Eagle River Valley, Alaska, 1980-81,
W83-00682 7C

Aquifer Data From Four Wells in the Mendenhall Valley Near Juneau, Alaska,
W83-00686 7C

ALBERTA
Meltwater Hydrology and Hydrochemistry in Snow- and Ice-Covered Mountain Catchments,
W83-00377 2C

Effects of Chlorinated Sewage Effluents on Fish in the Sheep River, Alberta,
W83-00582 5C

ALGAE
Metal Resistances of Chlorophyta From Rivers Polluted by Heavy Metals,
W83-00538 5C

Ecological and Physiological Profile of Filamentous Green Algae as Factors in the Production of Organic Matter and Control of Water Quality,
W83-00576 2H

Dissolved-Oxygen and Algal Conditions in Selected Locations of the Willamette River Basin, Oregon,
W83-00696 5A

ALGAL BLOOMS
Ecological Consequences of Long-Term Exposure of Anabaena Variabilis (Cyanophyceae) to Shifts in Environmental Factors,
W83-00391 5C

ALGAL CONTROL
Control of Algal Filamentous Bulking at the Southerly Wastewater Treatment Plant,
W83-00369 5D

ALGAL GROWTH
Grafham Water: A Discussion of Limnological Events During the 5-Year Period 1974-1978,
W83-00534 2H

Species Associations and Metal Contents of Algae From Rivers Polluted by Heavy Metals,
W83-00537 5C

Lake Erie Cladophora in Perspective,
W83-00661 2H

Ecological Studies and Mathematical Modeling of Cladophora in Lake Huron: 3. The Dependence of Growth Rates on Internal Phosphorus Pool Size,
W83-00662 2H

ALPINE REGIONS
Evapotranspiration at Two Mountain Sites During the Vegetation Period,
W83-00352 2D

Is Evaporation an Important Component in High Alpine Hydrology.
W83-00373 2D

ALPS
Is Evaporation an Important Component in High Alpine Hydrology.
W83-00373 2D

ALTERNATIVE WATER USE
Municipal and Domestic Use,
W83-00541 6D

AMOEBAE
Amoebae From Antarctic Soil and Water,
W83-00389 5A

ANABAENA VARIABILIS
Ecological Consequences of Long-Term Exposure of Anabaena Variabilis (Cyanophyceae) to Shifts in Environmental Factors,
W83-00391 5C

ANAEROBIC DIGESTION
Operating Experience With Thermophilic Anaerobic Digestion,
W83-00490 5D

Evaluation and Comparison of Digester Gas Mixing Systems,
W83-00500 5D

Anaerobic Treatment of an Industrial Wastewater Containing Acetic Acid, Furfural, and Sulphite,
W83-00587 5D

Stability and Performance of Anaerobic Fixed Film Reactors During Hydraulic Overloading at 10-35C,
W83-00670 5D

ANTARCTIC
Amoebae From Antarctic Soil and Water,
W83-00389 5A

ANTITRANSPIRANTS
Evapotranspiration From Riparian Vegetation: Water Relations and Irrecoverable Losses for Saltcedar,
W83-00663 3B

Evapotranspiration From Riparian Vegetation: Conserving Water by Reducing Saltcedar Transpiration,
W83-00664 3B

APPROPRIATION
Protecting Streamflows in California,
W83-00425 6E

AQUATIC ANIMALS
Mains Infestation Control Using Permethrin,
W83-00498 5F

AQUATIC DRIFT
Hydrobiological Studies of Eastern Lesser Antillean Islands VII. St. Lucia: Behavioural Drift and Other Movements of Freshwater Marsh Molluscs,
W83-00395 5B

AQUATIC PLANTS
Biology, Metabolism and Functions of Littoral Submersed Weedbeds of Lake Wingra, Wisconsin, USA: A Summary and Review,
W83-00351 2H

Effects of 2,4-D on Non-Target Species in Kerr Reservoir,
W83-00378 3B

Fate of Fenitrothion in Aquatic Microcosms and the Role of Aquatic Plants,
W83-00448 5B

AQUATIC WEED CONTROL
Effects of 2,4-D on Non-Target Species in Kerr Reservoir,
W83-00378 3B

AQUATIC WEEDS
The Use of Herbicides for Aquatic Weed Control in Water Supply Catchments,
W83-00496 3B

AQUIFERS
Geohydrology of the Preglacial Genesee Valley, Monroe County, New York,
W83-00554 7C

Geohydrology of the Valley-Fill Aquifer in the Endicott-Johnson City Area, Broome County, New York,
W83-00555 7C

Geohydrology of the Valley-Fill Aquifer in the Ramapo and Mahwah Rivers Area, Rockland County, New York,
W83-00556 7C

Hydrology and Chemical Quality of Ground Water in Kiowa County, Colorado,
W83-00561 7C

Geohydrology of the Valley-Fill Aquifer in the Jamestown Area, Chautauqua County, New York,
W83-00564 7C

Deep Oxygenated Ground Water: Anomaly or Common Occurrence.,
W83-00565 2F

Availability of Water From Aquifers in Upstate New York,
W83-00681 7C

Aquifer Data From Four Wells in the Mendenhall Valley Near Juneau, Alaska,
W83-00686 7C

Geohydrology of the Valley-Fill Aquifer in the Elmira Area, Chemung County, New York,
W83-00695 7C

Geohydrology of the Valley-Fill Aquifer in the Cortland-Homer-Preble Area, Cortland and Onondaga Counties, New York,
W83-00697 7C

Geohydrology of the Valley-Fill Aquifer in the Sprout and Fishkill Creeks Area, Dutchess County, New York,
W83-00698 7C

Geohydrology of the Glaciolacustrine Aquifer in the Fulton area, Oswego County, New York,
W83-00699 7C

ARIZONA
The Effect of Saline Seeps and Restricted Light Upon the Seasonal Dynamics of Phytoplankton Communities Within a Southwestern (USA) Desert Canyon Stream,
W83-00398 2K

Tamarisk and River-Channel Management,
W83-00428 4A

Deep Oxygenated Ground Water: Anomaly or Common Occurrence.,
W83-00565 2F

ARKANSAS
Deep Oxygenated Ground Water: Anomaly or Common Occurrence.,
W83-00565 2F

ARSENIC
Determination of Arsenic in Synthetic Fuel Process Waters,
W83-00402 5A

Determination of Arsenic in Potable, Fresh and Estuarine Water by Flameless Atomic Absorption,
W83-00405 5A

Community Health Associated With Arsenic in Drinking Water in Millard County, Utah,
W83-00630 5C

ARTESIAN WELLS
Data on Selected Deep Wells in South Florida,
W83-00689 7C

ATOMIC ABSORPTION SPECTROSCOPY
Use of a Hydride-Generation Technique for the Atomic Absorption Determination of Lead in Drinking Water,
W83-00401 5A

Determination of Arsenic in Synthetic Fuel Process Waters,
W83-00402 5A

Influence of Valence State on the Determination of Antimony, Arsenic, Bismuth, Selenium and Tellurium in Lake Water Using the Hydride AA Technique,
W83-00403 5A

Determination of Dissolved Selenium in Fresh and Estuarine Waters by Flameless Atomic Absorption,
W83-00404 5A

Determination of Arsenic in Potable, Fresh and Estuarine Water by Flameless Atomic Absorption,
W83-00405 5A

AUSTRALIA
Observations on Nitrate, Phosphate and Silicate in Cleveland Bay, Northern Queensland,
W83-00406 5A

Benthic Communities in an Estuary with Periodic Deoxygenation,
W83-00407 2L

Phosphorus Export from Coastal Plain Drainage Into the Peel-Harvey Estuarine System of Western Australia,
W83-00408 5B

Intertidal Community Offshore from the Werribee Sewage-Treatment Farm: An Opportunistic Infaunal Assemblage,
W83-00409 5C

Phosphorus and Nitrogen Loads in Waters Associated with River Murray Near Albury-Wodonga, and Their Effects on Phytoplankton Populations,
W83-00410 5C

Metal Levels in the Mussel Mytilus Edulis Collected from Estuaries in South-Eastern Australia,
W83-00411 5A

Trace Metal Speciation in Three Victorian Lakes,
W83-00412 5A

AUSTRIA
Glacial-Hydrological Investigations at the Vernagtferner Glacier as a Basis for a Discharge Model,
W83-00379 2A

AUSTRIAN ALPS
Evapotranspiration at Two Mountain Sites During the Vegetation Period,
W83-00352 2D

AUTOMATION
Continuous Monitoring, Automated Analysis, and Sampling Procedures,
W83-00488 5A

An Automatic Voltammetric Analyzer for the Simultaneous Determination of Toxic Trace Metals in Water,
W83-00510 7B

AVAILABLE WATER
Improvement of Irrigation Scheduling Techniques for Corn With Variable Corn Maturity Range, Plant Population and Water Supply Availability,
W83-00624 3F

Evapotranspiration From Riparian Vegetation: Water Relations and Irrecoverable Losses for Saltcedar,
W83-00663 3B

BACTERIA
Assessing Biomass and Production of Bacteria in Eutrophic Lake Mendota, Wisconsin,
W83-00384 2H

Generation of Fecal and Total Coliform Surges by Stream Flow Manipulation in the Absence of Normal Hydrometeorological Stimuli,
W83-00385 5B

Survival in Lake Water of Klebsiella Pneumoniae Discharged by a Paper Mill,
W83-00387 5B

Diluent Composition for Use of API 20E in Characterizing Marine and Estuarine Bacteria,
W83-00388 5A

Widespread Distribution of Ability to Oxidize Manganese Among Freshwater Bacteria,
W83-00390 5B

Phosphorus Reduction in a Man-Made Lake by Means of a Small Reservoir on the Inflow,
W83-00396 5G

Microbial Communities in Lake Plussee--An Analysis With Numerical Taxonomy of Isolates,
W83-00399 2H

Bacterial Water Quality: Springs and Streams in the Great Smoky Mountains National Park,
W83-00426 5A

Inaccuracy of the Preincubation Modified M-FC Method for Estimating Fecal Coliform Densities in Marine Waters,
W83-00491 5A

Microbial Metabolism of Acetate, Propionate, and Butyrate in Anoxic Sediment From the Colne Point Saltmarsh, Essex, U.K.,
W83-00519 2L

Establishing the Pattern of Heterotrophic Bacterial Activity in Three Central Amazonian Lakes,
W83-00523 2H

Electron Microscopic Investigation of Microorganisms in Waters of Different Color,
W83-00575 2H

Distribution of Enteroviruses in Sediments Contiguous With a Deep Marine Sewage Outfall,
W83-00645 5B

Interaction of Bacterial Plankton and Zooplankton in Oligotrophic Water Bodies,
W83-00648 2H

Microbiology: Detection of Bacterial Pathogens and Their Occurrence,
W83-00658 5A

BAFFIN ISLAND
Contemporary Sedimentary Environments on Baffin Island, N.W.T., Canada: Glaciomarine Processes in Fiords of Eastern Cumberland Peninsula,
W83-00400 2J

BANGLADESH
The Ganges Basin and the Water Dispute,
W83-00455 4A

BASELINE STUDIES
Statistical Summaries of Water-Quality Data for Two Coal Areas of Jackson County, Colorado,
W83-00550 7C

BELGIUM
Influence of Temperature and River Discharge on Water Quality of the Western Scheldt Estuary,
W83-00669 5C

BENTHIC FAUNA
Benthic Communities in an Estuary with Periodic Deoxygenation,
W83-00407 2L

BIOACCUMULATION
Bioaccumulation of Organochlorines by Yearling Coho Salmon (Oncorhynchus Kisutch Walbaum) Fed Diets Containing Great Lakes' Coho Salmon, and the Pathophysiological Responses of the Recipients,
W83-00418 5C

Kepone Distribution in Selected Tissues of Blue Crabs, Callinectes Sapidus, Collected From the James River and Lower Chesapeake Bay,
W83-00436 5B

Accumulation by Fish of Contaminants Released From Dredged Sediments,
W83-00449 5B

BIOASSAY
Accumulation by Fish of Contaminants Released From Dredged Sediments,
W83-00449 5B

BIOCHEMICAL OXYGEN DEMAND
Performance of Trickling Filter Plants: Reliability, Stability and Variability,
W83-00634 5D

BIODEGRADATION
Measurement of Aquatic Biodegradation Rates by Determining Heterotrophic Uptake of Radiolabeled Pollutants,
W83-00392 5B

Evaluation of the River Die-Away Biodegradation Test,
W83-00492 5B

Destruction of Organic Matter by Higher Water Plants Under Experimental Conditions,
W83-00597 2H

Biodegradation of Cellulose in Bottom Sediments of Lake Baikal,
W83-00600 5B

BIODEGRATION
Fate and Distribution of a Quaternary Ammonium Surfactant, Octadecyltrimethylammonium Chloride (OTAC), in Wastewater Treatment,
W83-00433 5D

BIOINDICATORS
Fundamental Principles of the Comparative Toxicological Experiment,
W83-00603 5C

BIOLOGICAL FILTERS
Biological Filters,
W83-00484 5D

BIOLOGICAL SAMPLES
Biological Surveillance of Rivers,
W83-00472 5A

BIOLOGICAL TREATMENT
The Theory and Design of Aerobic Biological Treatment,
W83-00413 5D

BIOLOGICAL WASTEWATER TREATMENT
Velocity-Dependent Reaction Rates in a Slime Reactor,
W83-00359 5D

BIOMASS
Phytoplankton of the Yenisey Bay,
W83-00577 2L

BOTSWANA
Groundwater Supply Exploration in Semi-Arid Regions for Livestock Extension--A Technical and Economic Appraisal,
W83-00459 6B

BOTTOM SEDIMENTS
The Main Approaches to the Study of the Cycle of Biological Elements in the Dnieper Reservoirs,
W83-00599 5B

BOUNDARY CONDITIONS
Convective Response of a Mass of Water Near 4 C to a Constant Cooling Rate Applied on Its Boundaries,
W83-00512 8B

BOUNDARY INTEGRAL EQUATION METHOD
Boundary Integral Solutions of Water Wave Problems,
W83-00463 8B

BRACKISH WATER
Desalting Seawater and Brackish Waters: 1981 Cost Update,
W83-00642 3A

BRAZIL
Establishing the Pattern of Heterotrophic Bacterial Activity in Three Central Amazonian Lakes,
W83-00523 2H

BRITISH COLUMBIA
Effect of Scale on the Complexity of Snowmelt Systems,
W83-00375 2C

Meltwater Hydrology and Hydrochemistry in Snow- and Ice-Covered Mountain Catchments,
W83-00377 2C

Sprinkler Irrigation Answers City Waste Problem,
W83-00574 3C

CADMIUM
Effect of EDTA on Cadmium in Activated Sludge Systems,
W83-00489 5D

CALCIUM HYDROXIDE
Removing Metals From Waste Solutions With Low Rank Coals and Related Materials,
W83-00471 5D

CALIFORNIA
Estimation of Small-Scale Hydropower Potential,
W83-00357 6A

Physical and Chemical Features of Playa Lakes in Southeastern California, USA,
W83-00372 2H

Protecting Streamflows in California,
W83-00425 6E

Operating Experience With Thermophilic Anaerobic Digestion,
W83-00490 5D

Drip vs. Flood--Viticulture Research: A Comparison of Two Irrigation Systems in California Vineyards,
W83-00588 3F

CARBON CYCLE
The Seasonal Cycle of Inorganic Carbon Species in Cazenovia Lake, New York, 1977,
W83-00532 2H

CARBON RADIOISOTOPES
Comparison Between the Carbon-14 and Oxygen Consumption Method for the Determination of the Activity of Heterotrophic Bacterial Populations,
W83-00569 2H

CARCINOGENS
Community Health Associated With Arsenic in Drinking Water in Millard County, Utah,
W83-00630 5C

CATFISH
Managing Water Quality in Channel Catfish Ponds,
W83-00666 5G

CAYUGA LAKE
The Eutrophication of Cayuga Lake: A Historical Analysis of the Phytoplankton's Response to Phosphate Detergents,
W83-00509 5C

CAZENOVIA LAKE
The Seasonal Cycle of Inorganic Carbon Species in Cazenovia Lake, New York, 1977,
W83-00532 2H

CELLULOSE
Biodegradation of Cellulose in Bottom Sediments of Lake Baikal,
W83-00600 5B

CENTRIFUGATION
Extraction and Analysis of Interstitial Water From Sandstone,
W83-00382 5A

CHANNEL IMPROVEMENT
Tamarisk and River-Channel Management,
W83-00428 4A

The Encouragement of Freshwater Crayfish Populations by Attention to the Construction and Maintenance of Waterways,
W83-00505 6G

CHAUTAUQUA LAKE
Changes in Submersed Macrophytes in Chautauqua Lake, 1937-1975,
W83-00535 2H

CHELATION
Effect of EDTA on Cadmium in Activated Sludge Systems,
W83-00489 5D

The Forms in Which Manganese Migrates in the Water of the Dnieper and the Desna,
W83-00601 5B

CHEMICAL COMPOSITION
Self-Consistent Least-Squares Method of Estimating Chemical Composition of the Sources of Chemical Constituents in Natural Waters,
W83-00353 2K

Meltwater Hydrology and Hydrochemistry in Snow- and Ice-Covered Mountain Catchments,
W83-00377 2C

The Density and Composition of Hypersaline Waters of a Mexican Lagoon,
W83-00572 2K

CHEMICAL PROPERTIES
Thermal Springs in the Salmon River Basin, Central Idaho,
W83-00552 1A

Hydrogeochemical Prospecting of Ore-Deposits, Demonstrated on Some Water Analyses From Peru. (Hydrogeochemische Prospektion Von Erzlagerstatten Dargestellt Anhand Einiger Wasseranalysen Aus Peru),
W83-00674 5B

CHEMICAL TREATMENT
Physical and Chemical Methods,
W83-00486 5D

CHEMICAL WASTES
Phthalate Ester Concentration Variations in Dated Sediment Cores From the Chesapeake Bay,
W83-00434 5B

CHEMILUMINESCENCE
Chemiluminescence Method for the Determination of Trace Amounts of Proteins in Natural Waters,
W83-00580 5A

CHESAPEAKE BAY
Phthalate Ester Concentration Variations in Dated Sediment Cores From the Chesapeake Bay,
W83-00434 5B

CHLORINATED HYDROCARBONS
Halocarbons as Tracer Substances in Studies of the Distribution Patterns of Chlorinated Waters in Coastal Areas,
W83-00435 5B

Chlorobenzenes in Sediments, Water, and Selected Fish From Lakes Superior, Huron, Erie, and Ontario,
W83-00444 5B

Destruction of Pollutants in Water With Ozone in Combination With Ultraviolet Radiation. 2. Natural Trihalomethane Precursors,
W83-00445 5F

Destruction of Pollutants in Water With Ozone in Combination With Ultraviolet Radiation. 1. General Principles and Oxidation of Tetrachloroethylene,
W83-00446 5F

Influence of Bromide and Ammonia Upon the Formation of Trihalomethanes Under Water-Treatment Conditions,
W83-00447 5F

CHLORINATED POLYVINYL CHLORIDE
Organic and Organotin Compounds Leached From PVC and CPVC Pipe,
W83-00633 5F

CHLORINATION
Influence of Bromide and Ammonia Upon the Formation of Trihalomethanes Under Water-Treatment Conditions,
W83-00447 5F

Swimming Pool Water Treatment in the UK,
W83-00470 5F

Disinfection,
W83-00487 5F

Effects of Chlorinated Sewage Effluents on Fish in the Sheep River, Alberta,
W83-00582 5C

CHLORINE DIOXIDE
Stability of Chlorine Dioxide in Aqueous Solution,
W83-00667 5D

CHLOROBENZENES
Chlorobenzenes in Sediments, Water, and Selected Fish From Lakes Superior, Huron, Erie, and Ontario,
W83-00444 5B

CHLOROPHYLL
High Frequency Endogenous Periodicities of Chlorophyll Synthesis in Estuarine Phytoplankton,
W83-00570 2L

CHLOROPHYLL A
Nutrient Dependence of Phytoplankton Production in Brown-Water Lakes With Special Reference to Lake Paijanne,
W83-00524 5C

CHLOROPHYTA
Metal Resistances of Chlorophyta From Rivers Polluted by Heavy Metals,
W83-00538 5C

CHROMATOGRAPHY
Rapid Screening Technique Utilising High-Performance Liquid Chromatography for Assessing Acrylamide Contamination in Effluents,
W83-00381 5A

Cation-Exchange Behaviour of a Range of Adsorbents and Chromatographic Supports With Regard to Their Suitability for Investigating Trace Metal S peciation in Natural Waters,
W83-00517 5A

Development of Analytical Test Procedures for Organic Pollutants in Wastewater - Application to Pesticides,
W83-00632 5A

The Use of Uric Acid as a Method of Tracing Domestic Sewage Discharges in Riverine, Estuarine and Coastal Water Environments,
W83-00646 5A

CHROMIUM
New Evaporation Process: Key to Zero Discharge for Electroplaters.
W83-00417 5D

The Structure and Abundance of Rybinsk Reservoir Zooplankton as a Function of the Concentration of Zinc and Chromium Compounds,
W83-00596 5C

CIVIL LAW
Legal Liability of Reclaimed Water System Proprietors,
W83-00620 6E

CLADOPHORA
Ecological and Physiological Profile of Filamentous Green Algae as Factors in the Production of Organic Matter and Control of Water Quality,
W83-00576 2H

Lake Erie Cladophora in Perspective,
W83-00661 2H

Ecological Studies and Mathematical Modeling of Cladophora in Lake Huron: 3. The Dependence of Growth Rates on Internal Phosphorus Pool Size,
W83-00662 2H

CLARIFICATION
Colour and Turbidity Removal With Reusable Magnetic Particles-III Immobilized Metal Hydroxide Gels,
W83-00506 5F

CLARIFIERS
Design and Construction of the Pennichuck Water Treatment Plant: The Equipment Supplier's View,
W83-00501 5F

CLASSIFICATION
Specification for Procurement of Water-Level Sensing Instrumentation, Specification Number HIF-I-1,
W83-00684 7B

CLEANUP
Brighten the Beds,
W83-00442 5D

Oil Spill Cleanup Fulfills Aim of Federal Water Pollution Control Act,
W83-00566 5G

CLIMATIC DATA
Instruments for Mountainous Areas,
W83-00361 7B

Surface-Water and Climatological Data, Salt Lake County, Utah, Water Year 1980,
W83-00559 7C

COAL
Removing Metals From Waste Solutions With Low Rank Coals and Related Materials,
W83-00471 5D

COAL GASIFICATION
Determination of Selected Organics in Treated Sludges and Associated Leachates From Coal Conversion Facilities,
W83-00383 5A

COAL MINING
Background Hydrologic Information in Potential Lignite Mining Areas in Mississippi, August 1981,
W83-00693 7C

COAL SLURRY PIPELINES
Characteristics and Application of Big Sandy River, Glenwood Springs, and Dotsero Springs Waters in Energy Development,
W83-00639 3C

COASTAL ZONE MANAGEMENT
Coastal Zone Development: Mitigation, Marsh Creation, and Decision-Making,
W83-00430 6G

COLD REGIONS
The Palaeolimnology of Lake Myvatn, Northern Iceland; Plant and Animal Microfossils in the Sediment,
W83-00533 2H

COLIFORMS
Inaccuracy of the Preincubation Modified M-FC Method for Estimating Fecal Coliform Densities in Marine Waters,
W83-00491 5A

COLLOIDS
Seasonal and Spatial Distribution of Humus Fractions in a Chain of Polyhumic Lakes in Southern Finland,
W83-00521 2H

COLOR
Electron Microscopic Investigation of Microorganisms in Waters of Different Color,
W83-00575 2H

COLORADO
Rapid Infiltration Treatment of Primary and Secondary Effluents,
W83-00358 5D

Statistical Summaries of Water-Quality Data for Two Coal Areas of Jackson County, Colorado,
W83-00550 7C

Hydrology and Chemical Quality of Ground Water in Kiowa County, Colorado,
W83-00561 7C

Colorado Water Rights - An Engineer's Case Studies,
W83-00675 6E

COLORADO RIVER
Primary Productivity and Nutrient Balance in a Lower Colorado River Reservoir,
W83-00394 2H

COMBINED SEWER OVERFLOWS
Evaluation of the Performance of a Combined Sewer Overflow Retention Tank,
W83-00627 5D

Cost-Effective Program for Combined Sewer Overflow Abatement,
W83-00659 5G

COMPOSTING
Composting Sewage Sludge by Means of Forced Aeration,
W83-00614 5E

COMPUTER MODELS
A Stormwater Management Model for the West Branch Brandywine Creek, Chester County, Pennsylvania,
W83-00562 4A

Simulation of Nutrient and Heavy Metal Transport Capacity of Suspended Sediment,
W83-00609 4D

An Applied Coupled Simulation-Optimization Model of Water Use Efficiency in Intensive Fish Culture Systems,
W83-00617 8I

Practical Application of Linear Programming and Network Flows - Proceedings of the Technology Transfer Workshop.
W83-00628 6A

Data Management System for Urban Hydrology Studies Program,
W83-00683 7C

COMPUTER PROGRAMS
Water Resources and Environmental Planning Using Interactive Graphics,
W83-00456 6A

Effect of Length of Fallow Period on Water Storage and Drainage,
W83-00618 3F

Data Management System for Urban Hydrology Studies Program,
W83-00683 7C

CONCRETE DAMS
Piping Potential of Weak Zones Under Concrete Dams,
W83-00356 8A

Abnormal Behaviour of Zeuzier Arch-Dam (Switzerland), III. Geodetic Deformation Measurements,
W83-00364 8A

CONCRETE TECHNOLOGY
Abnormal Behaviour of Zeuzier Arch-Dam (Switzerland) V. Examination of Condition and Evaluation of Repair Methods,
W83-00366 8A

CONDUCTIOMETRIC TECHNIQUES
A Conductiometric Technique for Measuring the Water Velocity in Salmonid Spawning Beds,
W83-00644 2F

CONDUCTIVITY
Meltwater Hydrology and Hydrochemistry in Snow- and Ice-Covered Mountain Catchments,
W83-00377 2C

CONNECTICUT
The Concentration, Reactivity and Fate of Copper, Nickel and Zinc Associated with a Cooling-Water Plume in Estuarine Waters,
W83-00443 5B

CONSTRUCTION
Design and Construction of the Pennichuck Water Treatment Plant: The Owner's View,
W83-00502 5F

CONTROLLED DRAINAGE
Effect of Length of Fallow Period on Water Storage and Drainage,
W83-00618 3F

CONVECTION
Convective Response of a Mass of Water Near 4 C to a Constant Cooling Rate Applied on Its Boundaries,
W83-00512 8B

Convection in Bottom Sediments and its Role in Material Exchange Between Water and Sediments,
W83-00531 5B

COOLING
Convective Response of a Mass of Water Near 4 C to a Constant Cooling Rate Applied on Its Boundaries,
W83-00512 8B

COOLING WATER
The Concentration, Reactivity and Fate of Copper, Nickel and Zinc Associated with a Cooling-Water Plume in Estuarine Waters,
W83-00443 5B

Seasonal Succession of Phytoplankton in an Ice-Free Pond Warmed by a Thermal Power Plant,
W83-00605 5C

Characteristics and Application of Big Sandy River, Glenwood Springs, and Dotsero Springs Waters in Energy Development,
W83-00639 3C

COOLING WATERS
Halocarbons as Tracer Substances in Studies of the Distribution Patterns of Chlorinated Waters in Coastal Areas,
W83-00435 5B

COPPER
Extraction-Spectrophotometric Determination of Copper (II) with 4-(2-Pyridylazo) Resorcinol and a Long-Chain Quaternary Ammonium Salt,
W83-00354 5A

The Concentration, Reactivity and Fate of Copper, Nickel and Zinc Associated with a Cooling-Water Plume in Estuarine Waters,
W83-00443 5B

CORN
Improvement of Irrigation Scheduling Techniques for Corn With Variable Corn Maturity Range, Plant Population and Water Supply Availability,
W83-00624 3F

CORRELATION ANALYSIS
Probability of Annual Flows of the Greater Zab River,
W83-00457 2E

CORROSION
Evaluating the Potential for Contaminating Drinking Water From the Corrosion of Tin-Antimony Solder,
W83-00452 5B

COST-BENEFIT ANALYSIS
The Economics of Water Allocation,
W83-00544 6E

The Economic Efficiency of Flood Plain Development,
W83-00545 6F

COSTS
Desalting Seawater and Brackish Waters: 1981 Cost Update,
W83-00642 3A

Treatment Costs Savings Through Monthly Variable Effluent Limits,
W83-00660 6F

CRABS
Kepone Distribution in Selected Tissues of Blue Crabs, Callinectes Sapidus, Collected From the James River and Lower Chesapeake Bay,
W83-00436 5B

CRAYFISH
The Encouragement of Freshwater Crayfish Populations by Attention to the Construction and Maintenance of Waterways,
W83-00505 6G

CROP PRODUCTION
Agriculture,
W83-00540 3F

CROP YIELD
Improvement of Irrigation Scheduling Techniques for Corn With Variable Corn Maturity Range, Plant Population and Water Supply Availability,
W83-00624 3F

Effect of Liquid Wastewater Sludge Application on Crop Yield and Water Quality,
W83-00656 5E

CROPLAND
Irrigation in America-Today and Tomorrow,
W83-00592 3F

CRUSTACEANS
Distribution of Littoral Crustaceans in the Pelagic Zone of Lake Glubokoye,
W83-00595 2H

CURRENT METERS
Observations From Moored Current Meters in San Francisco Bay, 1978.
W83-00551 7B

CYANPHYTA
Ecological Consequences of Long-Term Exposure of Anabaena Variabilis (Cyanophyceae) to Shifts in Environmental Factors,
W83-00391 5C

CZECHOSLOVAKIA
Phosphorus Reduction in a Man-Made Lake by Means of a Small Reservoir on the Inflow,
W83-00396 5G

Oxygen Consumption and Ammonia and Phosphate Excretion in Pond Zooplankton,
W83-00571 2H

DAM DESIGN
Penstock Entrance Research- Auburn Dam Entrance,
W83-00638 8A

DAM EFFECTS
The Impact of Damming the Don River on the Natural Reproduction of the Diadromous Shad,
W83-00593 6G

DAM FAILURE
Abnormal Behaviour of Zeuzier Arch-Dam (Switzerland). II. Abnormal Dam Deformations and First Investigations About Their Origin,
W83-00363 8A

Abnormal Behaviour of Zeuzier Arch-Dam (Switzerland), III. Geodetic Deformation Measurements,
W83-00364 8A

Abnormal Behaviour of Zeuzier Arch-Dam (Switzerland), IV. Geological Aspects of the Extraordinary Behaviour of Zeuzier Arch Dam,
W83-00365 8A

Abnormal Behaviour of Zeuzier Arch-Dam (Switzerland) V. Examination of Condition and Evaluation of Repair Methods,
W83-00366 8A

Abnormal Behaviour of Zeuzier Arch-Dam (Switzerland) VI. Static Calculations,
W83-00367 8A

Abnormal Behaviour of Zeuzier Arch-Dam (Switzerland) VII. Programs for Refilling and Monitoring,
W83-00368 8A

Abnormal Behavior of Zeuzier Arch-Dam (Switzerland) I. General View,
W83-00508 8A

DAM FOUNDATION
Piping Potential of Weak Zones Under Concrete Dams,
W83-00356 8A

DAMS
Remedial Treatment Exploration, Wolf Creek Dam, KY,
W83-00651 8E

DANUBE RIVER ESTUARY
Ecological Assessment of Water Quality in the Estuarine Region of the Danube,
W83-00602 5B

DATA COLLECTION
Water Quality Monitoring: What Directions Should New Programs Take,
W83-00429 5A

DATA COLLECTIONS
Observations From Moored Current Meters in San Francisco Bay, 1978.
W83-00551 7B

Surface-Water and Climatological Data, Salt Lake County, Utah, Water Year 1980,
W83-00559 7C

An Evaluation of Water-Quality Monitoring in the Brandywine Creek Basin, Pennsylavania, 1973-78,
W83-00560 7C

Data Management System for Urban Hydrology Studies Program,
W83-00683 7C

Aquifer Data From Four Wells in the Mendenhall Valley Near Juneau, Alaska,
W83-00686 7C

Ground-Water Quality in East-Central Idaho Valleys,
W83-00694 7C

DATA STORAGE AND RETRIVAL
Data Management System for Urban Hydrology Studies Program,
W83-00683 7C

DECOMPOSITION
Destruction of Organic Matter by Higher Water Plants Under Experimental Conditions,
W83-00597 2H

DEEP WELLS
Data on Selected Deep Wells in South Florida,
W83-00689 7C

DEFORMATION
Abnormal Behaviour of Zeuzier Arch-Dam (Switzerland). II. Abnormal Dam Deformations and First Investigations About Their Origin,
W83-00363 8A

Abnormal Behaviour of Zeuzier Arch-Dam (Switzerland), III. Geodetic Deformation Measurements,
W83-00364 8A

Abnormal Behaviour of Zeuzier Arch-Dam (Switzerland), IV. Geological Aspects of the Extraordinary Behaviour of Zeuzier Arch Dam,
W83-00365 8A

Abnormal Behaviour of Zeuzier Arch-Dam (Switzerland) V. Examination of Condition and Evaluation of Repair Methods,
W83-00366 8A

Abnormal Behaviour of Zeuzier Arch-Dam (Switzerland) VI. Static Calculations,
W83-00367 8A

Abnormal Behaviour of Zeuzier Arch-Dam (Switzerland) VII. Programs for Refilling and Monitoring,
W83-00368 8A

Abnormal Behavior of Zeuzier Arch-Dam (Switzerland) I. General View,
W83-00508 8A

DEGRADATION
Dissolved Humic Materials: Photodegradation, Sediment Effects, and Reactivity with Phosphate and Calcium Carbonate Precipitation,
W83-00397 2H

Fate of Fenitrothion in Aquatic Microcosms and the Role of Aquatic Plants,
W83-00448 5B

DEICERS
The Character and Dispersal of Motorway Run-Off Water,
W83-00461 5B

Hydrologic Effects on Highway-Deicing Chemicals in Massachusetts,
W83-00558 5B

DELAWARE
Water Resources Data for Maryland and Delaware, Water Year 1981.
W83-00700 7C

DENITRIFICATION
Denitrification,
W83-00480 5D

DENSITY
The Density and Composition of Hypersaline Waters of a Mexican Lagoon,
W83-00572 2K

DENSITY STRATIFICATION
Vertical Circulation in Density-Stratified Reservoir,
W83-00676 2H

DESALINATION
Making Salt Water Drinkable,
W83-00438 3A

Reverse Osmosis in an Unstirred Batch System. II. Analysis on Transport Phenomena Across Membrane,
W83-00583 3A

Desalting Seawater and Brackish Waters: 1981 Cost Update,
W83-00642 3A

DESIGN CRITERIA
The Theory and Design of Aerobic Biological Treatment,
W83-00413 5D

Composite Performance Charts for Drip Irrigation Tubing,
W83-00589 3F

Site Evaluation, Design, Operation, and Installation of Home Sewage Systems in Iowa,
W83-00621 5D

DESORPTION
Desorption of Ru106, Cs134, Cs137, Ce144 and Am241 From Intertidal Sediment Contaminated by Nuclear Fuel Reprocessing Effluents,
W83-00437 5B

DEVELOPING COUNTRIES
Development Process for Improving Irrigation Water Management,
W83-00458 3F

DEWATERING
Uprating Sludge Treatment Processes,
W83-00462 5E

A Solution to Screenings Problems by Dewatering and Incineration,
W83-00473 5D

DIATOMS
The Effect of Land Use on the Diatom Communities in Lakes,
W83-00530 5C

DIGESTION
Evaluation and Comparison of Digester Gas Mixing Systems,
W83-00500 5D

DISINFECTION
Disinfection.
W83-00466 5F

Swimming Pool Water Treatment in the UK,
W83-00470 5F

Disinfection,
W83-00487 5F

Stability of Chlorine Dioxide in Aqueous Solution,
W83-00667 5D

DISSOLVED OXYGEN
Benthic Communities in an Estuary with Periodic Deoxygenation,
W83-00407 2L

An Oxygen Model for Lake Haukivesi,
W83-00525 5C

Deep Oxygenated Ground Water: Anomaly or Common Occurrence.,
W83-00565 2F

Survival and Growth of Phytophagous Fish as a Function of Oxygen Concentration in Water,
W83-00594 5C

Dissolved-Oxygen and Algal Conditions in Selected Locations of the Willamette River Basin, Oregon,
W83-00696 5A

DISTRICT OF COLUMBIA
Analysis of Water Supply Costs in the Washington (D.C.) Area,
W83-00467 6B

DIURNAL VARIATION
Diel Dynamics of Phytoplankton in Lake Kandry-Kul,
W83-00578 2H

DREDGING
The Encouragement of Freshwater Crayfish Populations by Attention to the Construction and Maintenance of Waterways,
W83-00505 6G

DRINKING WATER
Daily Intake of Lead, Cadmium, Copper, and Zinc From Drinking Water: The Seattle Study of Trace Metal Exposure,
W83-00431 5B

Components of Variation in Lead, Cadmium, Copper, and Zinc Concentration in Home Drinking Water: The Seattle Study of Trace Metal Exposure,
W83-00432 5A

Evaluating the Potential for Contaminating Drinking Water From the Corrosion of Tin-Antimony Solder,
W83-00452 5B

Determining Free Available Chlorine by DPD-Colorimetric, DPD-Steadifac (Colorimetric), and Facts Procedures,
W83-00453 5A

Disinfection.
W83-00466 5F

EPA and Water Supply--Present and Future,
W83-00493 5G

Evaluation of the Tentative Standard Method for Enteric Virus Concentration and Detection,
W83-00629 5A

Community Health Associated With Arsenic in Drinking Water in Millard County, Utah,
W83-00630 5C

DRIP IRRIGATION

Drip vs. Flood--Viticulture Research: A Comparison of Two Irrigation Systems in California Vineyards,
W83-00588 3F

Composite Performance Charts for Drip Irrigation Tubing,
W83-00589 3F

Drip Tested on Florida Ornamentals, Evaluation of Drip Irrigation for Container Production of Woody Landscape Plants,
W83-00591 3F

DUNES

Shape and Dimensions of Stationary Dunes in Rivers,
W83-00451 2J

EARTHWORKS

Remedial Treatment Exploration, Wolf Creek Dam, KY,
W83-00651 8E

ECONOMETRICS

Optimal Planning of Irrigation Distribution and Application Systems for a Large Irrigated Area,
W83-00616 3F

ECONOMIC ASPECTS

Groundwater Supply Exploration in Semi-Arid Regions for Livestock Extension--A Technical and Economic Appraisal,
W83-00459 6B

The Economics of Municipal Wastewater Reuse,
W83-00465 6B

ECONOMIC EFFICIENCY

The Economic Efficiency of Flood Plain Development,
W83-00545 6F

ECONOMIC EVALUATION

An Economic Evaluation of Citizen Suits,
W83-00619 6E

Economic Evaluation of Groundwater Policy Alternatives in the Northern Great Plains,
W83-00623 4B

ECOSYSTEMS

Steady-State Ecosystem Modeling for Lake Management,
W83-00610 5G

EDUCATION

Making Salt Water Drinkable,
W83-00438 3A

EFFLUENT LIMITATIONS

'Plain Meaning' Decision Clarifies Standard for Effluent Limitations,
W83-00567 6E

Treatment Costs Savings Through Monthly Variable Effluent Limits,
W83-00660 6F

EFFLUENTS

Performance of Trickling Filter Plants: Reliability, Stability and Variability,
W83-00634 5D

The Use of Uric Acid as a Method of Tracing Domestic Sewage Discharges in Riverine, Estuarine and Coastal Water Environments,
W83-00646 5A

ELECTRON MICROSCOPY

Electron Microscopic Investigation of Microorganisms in Waters of Different Color,
W83-00575 2H

ELECTROPLATING

New Evaporation Process: Key to Zero Discharge for Electroplaters.
W83-00417 5D

EMULSIONS

Factors Limiting Emulsified Lipid Treatment Capacity of Activated Sludge,
W83-00499 5D

ENERGY CONVERSION

Energy,
W83-00543 6C

ENERGY DEVELOPMENT

Characteristics and Application of Big Sandy River, Glenwood Springs, and Dotsero Springs Waters in Energy Development,
W83-00639 3C

ENERGY LOSS

Oxygen Injection Into a Rising Main: Its Effect on Pumping,
W83-00474 5D

ENGLAND

Generation of Fecal and Total Coliform Surges by Stream Flow Manipulation in the Absence of Normal Hydrometeorological Stimuli,
W83-00385 5B

Desorption of Ru106, Cs134, Cs137, Ce144 and Am241 From Intertidal Sediment Contaminated by Nuclear Fuel Reprocessing Effluents,
W83-00437 5B

Water Engineering Research at Swindon.
W83-00469 5F

A Solution to Screenings Problems by Dewatering and Incineration,
W83-00473 5D

Oxygen Injection Into a Rising Main: Its Effect on Pumping,
W83-00474 5D

First Impressions of a Novel Aeration System for Activated Sludge Plants,
W83-00475 5D

The Encouragement of Freshwater Crayfish Populations by Attention to the Construction and Maintenance of Waterways,
W83-00505 6G

Ground-Water Pollution Investigations in the Great Ouse Basin. II-Solid Waste Disposal,
W83-00507 5B

Growth and Recession of Aquatic Macrophytes on a Shaded Section of the River Lambourn, England, From 1971 to 1980,
W83-00520 2I

Grafham Water: A Discussion of Limnological Events During the 5-Year Period 1974-1978,
W83-00534 2H

Species Associations and Metal Contents of Algae From Rivers Polluted by Heavy Metals,
W83-00537 5C

Metal Resistances of Chlorophyta From Rivers Polluted by Heavy Metals,
W83-00538 5C

Some Effects of Organic Pollution on the Distribution and Seasonal Incidence of Chironomidae in Riffles in the River Cole,
W83-00539 5C

Dispersion Patterns of Phytoplankton in Lakes,
W83-00581 2H

ENVIRONMENTAL EFFECTS

Benthic Communities in an Estuary with Periodic Deoxygenation,
W83-00407 2L

ENVIRONMENTAL PROTECTION

Legal Liability of Reclaimed Water System Proprietors,
W83-00620 6E

EPISCHURA BAICALENSIS

Interaction of Bacterial Plankton and Zooplankton in Oligotrophic Water Bodies,
W83-00648 2H

EROSION

Simulation of Nutrient and Heavy Metal Transport Capacity of Suspended Sediment,
W83-00609 4D

Frozen Soil Effects on the Erosion Hazard,
W83-00615 2J

EROSION CONTROL

Nonpoint-Source Pollution Control: A Resource Conservation Perspective,
W83-00665 5G

ESTUARIES

Benthic Communities in an Estuary with Periodic Deoxygenation,
W83-00407 2L

Dynamics of Mixing in Estuaries,
W83-00420 2L

Observations From Moored Current Meters in San Francisco Bay, 1978.
W83-00551 7B

ESTUARINE ENVIRONMENT

Factors Affecting the Toxic Effect of Tin on Estuarine Microorganisms,
W83-00393 5C

Ecological Assessment of Water Quality in the Estuarine Region of the Danube,
W83-00602 5B

Influence of Temperature and River Discharge on Water Quality of the Western Scheldt Estuary,
W83-00669 5C

ETHYLENEDIAMINE TETRAACETIC ACID

Effect of EDTA on Cadmium in Activated Sludge Systems,
W83-00489 5D

EUTROPHIC LAKES

Assessing Biomass and Production of Bacteria in Eutrophic Lake Mendota, Wisconsin,
W83-00384 2H

The Role of Nitrogen as a Growth Limiting Factor in the Eutrophic Lake Vesijarvi, Southern Finland,
W83-00604 2H

EUTROPHICATION
Assessing Biomass and Production of Bacteria in Eutrophic Lake Mendota, Wisconsin,
W83-00384 2H

Eutrophication,
W83-00477 5C

The Eutrophication of Cayuga Lake: A Historical Analysis of the Phytoplankton's Response to Phosphate Detergents,
W83-00509 5C

Managing Water Quality in Channel Catfish Ponds,
W83-00666 5G

The Response of a Perch, Perca Fluviatilis L., Population to Eutrophication and Associated Changes in Fish Fauna in a Small Lake,
W83-00678 5C

EVALUATION
Model Protocol for the Comprehensive Evaluation of Publicly Owned Treatment Works Performance and Operation,
W83-00631 5D

EVAPORATION
Is Evaporation an Important Component in High Alpine Hydrology.
W83-00373 2D

The Density and Composition of Hypersaline Waters of a Mexican Lagoon,
W83-00572 2K

EVAPOTRANSPIRATION
Evapotranspiration at Two Mountain Sites During the Vegetation Period,
W83-00352 2D

Evapotranspiration From Riparian Vegetation: Water Relations and Irrecoverable Losses for Saltcedar,
W83-00663 3B

Evapotranspiration From Riparian Vegetation: Conserving Water by Reducing Saltcedar Transpiration,
W83-00664 3B

EVAPOTRANSPIRATION POTENTIAL
Improvement of Irrigation Scheduling Techniques for Corn With Variable Corn Maturity Range, Plant Population and Water Supply Availability,
W83-00624 3F

EXCRETION
Excretion of Dissolved Organic Phosphorus in Tropical Brackish Waters,
W83-00419 2L

Oxygen Consumption and Ammonia and Phosphate Excretion in Pond Zooplankton,
W83-00571 2H

EXPLORATION
Groundwater Supply Exploration in Semi-Arid Regions for Livestock Extension--A Technical and Economic Appraisal,
W83-00459 6B

EXPLOSIVES
Pollution From US Explosives and Propellants Production,
W83-00441 5D

FALLOWING
Effect of Length of Fallow Period on Water Storage and Drainage,
W83-00618 3F

FARMING
Agriculture,
W83-00540 3F

FATE OF POLLUTANTS
Measurement of Aquatic Biodegradation Rates by Determining Heterotrophic Uptake of Radiolabeled Pollutants,
W83-00392 5B

Kepone Distribution in Selected Tissues of Blue Crabs, Callinectes Sapidus, Collected From the James River and Lower Chesapeake Bay,
W83-00436 5B

Fate of Fenitrothion in Aquatic Microcosms and the Role of Aquatic Plants,
W83-00448 5B

FATTY ACIDS
Microbial Metabolism of Acetate, Propionate, and Butyrate in Anoxic Sediment From the Colne Point Saltmarsh, Essex, U.K.,
W83-00519 2L

FENITROTHION
Fate of Fenitrothion in Aquatic Microcosms and the Role of Aquatic Plants,
W83-00448 5B

FERTILIZERS
Phosphorus Export from Coastal Plain Drainage Into the Peel-Harvey Estuarine System of Western Australia,
W83-00408 5B

Some Options for Treating Liquid Wastes From Nitrogen Fertilizer Factories,
W83-00440 5D

FILMS
Flow Beneath a Stagnant Film on Water: The Reynolds Ridge,
W83-00516 8B

FILTERS
Biological Filters,
W83-00484 5D

FILTRATION
A Solution to Screenings Problems by Dewatering and Incineration,
W83-00473 5D

Design and Construction of the Pennichuck Water Treatment Plant: The Equipment Supplier's View,
W83-00501 5F

FINLAND
Survival in Lake Water of Klebsiella Pneumoniae Discharged by a Paper Mill,
W83-00387 5B

Seasonal and Spatial Distribution of Humus Fractions in a Chain of Polyhumic Lakes in Southern Finland,
W83-00521 2H

Carbon, Phosphorus and Nitrogen Budgets of the Littoral Equisetum Belt in an Oligotrophic Lake,
W83-00522 2H

Nutrient Dependence of Phytoplankton Production in Brown-Water Lakes With Special Reference to Lake Paijanne,
W83-00524 5C

An Oxygen Model for Lake Haukivesi,
W83-00525 5C

Winter Microbial Activity in Lake Tuusulanjarvi,
W83-00528 5G

The Effect of Land Use on the Diatom Communities in Lakes,
W83-00530 5C

Convection in Bottom Sediments and its Role in Material Exchange Between Water and Sediments,
W83-00531 5B

The Influence of Sulphite Mill Effluents on Heterotrophic Activity as Measured by Glucose Assimilation,
W83-00536 5C

The Role of Nitrogen as a Growth Limiting Factor in the Eutrophic Lake Vesijarvi, Southern Finland,
W83-00604 2H

FIORDS
Contemporary Sedimentary Environments on Baffin Island, N.W.T., Canada: Glaciomarine Processes in Fiords of Eastern Cumberland Peninsula,
W83-00400 2J

FIRN
Application of the Gravity Flow Theory to the Percolation of Melt Water Through Firn,
W83-00513 2C

FISH
The Resorption of Zinc From Scales of Sea Trout (Salmo Trutta) During the Upstream Spawning Migration,
W83-00511 5B

Survival and Growth of Phytophagous Fish as a Function of Oxygen Concentration in Water,
W83-00594 5C

FISH BARRIERS
An Analysis of Mesh Sizes Required for Screening Fishes at Water Intakes,
W83-00450 8I

FISH FARMING
The Influence of River Flow on Pelagic Sardine Catches in Lake Kariba,
W83-00518 2H

Managing Water Quality in Channel Catfish Ponds,
W83-00666 5G

FISH MANAGEMENT
An Applied Coupled Simulation-Optimization Model of Water Use Efficiency in Intensive Fish Culture Systems,
W83-00617 8I

FISH POPULATIONS
Effects of Chlorinated Sewage Effluents on Fish in the Sheep River, Alberta,
W83-00582 5C

The Impact of Damming the Don River on the Natural Reproduction of the Diadromous Shad,
W83-00593 6G

Studies of the Limnology, Fish Populations, and Fishery of Turquoise Lake, Colorado - 1979-80,
W83-00640 2H

The Response of a Perch, Perca Fluviatilis L., Population to Eutrophication and Associated Changes in Fish Fauna in a Small Lake,
W83-00678 5C

FLOOD CHANNELS
Tamarisk and River-Channel Management,
W83-00428 4A

FLOOD DATA
Flood Data in West Windsor Township, Mercer County, New Jersey Through 1981 Water Year,
W83-00690 7C

FLOOD DISCHARGE
Flood Data in West Windsor Township, Mercer County, New Jersey Through 1981 Water Year,
W83-00690 7C

FLOOD FLOW
A Rapid, Low-Cost Technique for Estimating Peak Flow for Selected Flood Events,
W83-00613 2E

FLOOD PEAK
A Rapid, Low-Cost Technique for Estimating Peak Flow for Selected Flood Events,
W83-00613 2E

Flood Data in West Windsor Township, Mercer County, New Jersey Through 1981 Water Year,
W83-00690 7C

FLOOD PLAIN ZONING
The Economic Efficiency of Flood Plain Development,
W83-00545 6F

FLOOD ROUTING
A Stormwater Management Model for the West Branch Brandywine Creek, Chester County, Pennsylvania,
W83-00562 4A

FLOODS
The Economic Efficiency of Flood Plain Development,
W83-00545 6F

Flood Data in West Windsor Township, Mercer County, New Jersey Through 1981 Water Year,
W83-00690 7C

FLORIDA
Widespread Distribution of Ability to Oxidize Manganese Among Freshwater Bacteria,
W83-00390 5B

Drip Tested on Florida Ornamentals, Evaluation of Drip Irrigation for Container Production of Woody Landscape Plants,
W83-00591 3F

Distribution of Enteroviruses in Sediments Contiguous With a Deep Marine Sewage Outfall,
W83-00645 5B

Data on Selected Deep Wells in South Florida,
W83-00689 7C

FLOW AUGMENTATION
The Ganges Basin and the Water Dispute,
W83-00455 4A

FLOW CHARACTERISTICS
Probability of Annual Flows of the Greater Zab River,
W83-00457 2E

Low-Flow Characteristics of Ohio Streams,
W83-00563 7C

FLOW CONTROL
Urban Runoff Control Technology,
W83-00416 5D

FLOW MEASUREMENT
Acoustic Systems for the Measurement of Streamflow,
W83-00692 7B

FLOW NETS
Practical Application of Linear Programming and Network Flows - Proceedings of the Technology Transfer Workshop.
W83-00628 6A

FLOW PATTERNS
Flow Beneath a Stagnant Film on Water: The Reynolds Ridge,
W83-00516 8B

FLOWMETERS
Acoustic Systems for the Measurement of Streamflow,
W83-00692 7B

FLUID MECHANICS
Flow Beneath a Stagnant Film on Water: The Reynolds Ridge,
W83-00516 8B

FLUIDIZED BEDS
Sludge Incineration With Energy Recovery,
W83-00608 5E

FOLICOTE
Evapotranspiration From Riparian Vegetation: Conserving Water by Reducing Saltcedar Transpiration,
W83-00664 3B

FOOD HABITS
The Feeding of Kanev Reservoir Fishes in Connection With the Discharge of Heated Water From the Tripol'ye Power Station,
W83-00598 5C

FOOD PROCESSING WASTES
Factors Limiting Emulsified Lipid Treatment Capacity of Activated Sludge,
W83-00499 5D

FOREBAYS
Installation of Flexible Membrane Lining in Mt. Elbert Forebay Reservoir,
W83-00641 8G

FOREST HYDROLOGY
A Computer Simulation of the Effects of Differing Crop Types on the Water Balance of Small Catchments Over Long Time Periods,
W83-00585 2D

FORESTED WATERSHEDS
Simulation of Nutrient and Heavy Metal Transport Capacity of Suspended Sediment,
W83-00609 4D

FOURIER ANALYSIS
A Fourier Method for Solving Nonlinear Water-Wave Problems: Application to Solitary-Wave Interactions,
W83-00514 8B

FRANCE
Comparison Between the Carbon-14 and Oxygen Consumption Method for the Determination of the Activity of Heterotrophic Bacterial Populations,
W83-00569 2H

Investigation on the Microbiology of the Saar River (Untersuchung Zur Microbiologie Der Saar),
W83-00649 5B

FROZEN GROUND
Frozen Soil Effects on the Erosion Hazard,
W83-00615 2J

GANGES RIVER
The Ganges Basin and the Water Dispute,
W83-00455 4A

GEOCHEMISTRY
Self-Consistent Least-Squares Method of Estimating Chemical Composition of the Sources of Chemical Constituents in Natural Waters,
W83-00353 2K

Physical and Chemical Features of Playa Lakes in Southeastern California, USA,
W83-00372 2H

GEOHYDROLOGY
Hydrology and Chemical Quality of Ground Water in Kiowa County, Colorado,
W83-00561 7C

Regional Geohydrology of the Northern Louisian Salt-Dome Basin, Part I, Conceptual Model and Data Needs,
W83-00691 2F

GEOLOGIC MAPPING
Geohydrology of the Preglacial Genesee Valley, Monroe County, New York,
W83-00554 7C

Geohydrology of the Valley-Fill Aquifer in the Endicott-Johnson City Area, Broome County, New York,
W83-00555 7C

Geohydrology of the Valley-Fill Aquifer in the Ramapo and Mahwah Rivers Area, Rockland County, New York,
W83-00556 7C

Geohydrology of the Valley-Fill Aquifer in the Jamestown Area, Chautauqua County, New York,
W83-00564 7C

Geohydrology of the Valley-Fill Aquifer in the Elmira Area, Chemung County, New York,
W83-00695 7C

Geohydrology of the Valley-Fill Aquifer in the Cortland-Homer-Preble Area, Cortland and Onondaga Counties, New York,
W83-00697 7C

Geohydrology of the Valley-Fill Aquifer in the Sprout and Fishkill Creeks Area, Dutchess County, New York,
W83-00698 7C

Geohydrology of the Glaciolacustrine Aquifer in the Fulton area, Oswego County, New York,
W83-00699 7C

GEORGIA
A Comparative Analysis of the C02 and Water Vapor Responses of Two Spartina Species From Georgia Coastal Marshes,
W83-00421 2I

Treatment Costs Savings Through Monthly Variable Effluent Limits,
W83-00660 6F

GEOTHERMAL STUDIES
Thermal Springs in the Salmon River Basin, Central Idaho,
W83-00552 1A

GILA RIVER
Tamarisk and River-Channel Management,
W83-00428 4A

GLACIERS
Glacial-Hydrological Investigations at the Vernagtferner Glacier as a Basis for a Discharge Model,
W83-00379 2A

GRAFHAM WATER
Grafham Water: A Discussion of Limnological Events During the 5-Year Period 1974-1978,
W83-00534 2H

GRAPES
Drip vs. Flood--Viticulture Research: A Comparison of Two Irrigation Systems in California Vineyards,
W83-00588 3F

GRAPHICAL ANALYSIS
Water Resources and Environmental Planning Using Interactive Graphics,
W83-00456 6A

GRAVITY FLOW THEORY
Application of the Gravity Flow Theory to the Percolation of Melt Water Through Firn,
W83-00513 2C

GREAT LAKES
Bioaccumulation of Organochlorines by Yearling Coho Salmon (Oncorhynchus Kisutch Walbaum) Fed Diets Containing Great Lakes' Coho

Salmon, and the Pathophysiological Responses of the Recipients,
W83-00418 5C

Chlorobenzenes in Sediments, Water, and Selected Fish From Lakes Superior, Huron, Erie, and Ontario,
W83-00444 5B

GREAT OUSE BASIN
Ground-Water Pollution Investigations in the Great Ouse Basin. II-Solid Waste Disposal,
W83-00507 5B

GROUNDWATER
Water Resources Data for Arizona, Water Year 1980.
W83-00546 7C

Water Resources Data for Washington, Water Year 1980--Volume 2. Eastern Washington.
W83-00547 7C

Water Resources Data for Washington, Water Year 1980--Volume 1. Western Washington.
W83-00548 7C

Water Resources Data, New York, Water Year 1981--Volume 1. Eastern New York Excluding Long Island.
W83-00549 7C

January 1981 Water Levels, and Data Related to Water-Level Changes, Western and South-Central Kansas,
W83-00553 7C

Geohydrology of the Preglacial Genesee Valley, Monroe County, New York,
W83-00554 7C

Geohydrology of the Valley-Fill Aquifer in the Endicott-Johnson City Area, Broome County, New York,
W83-00555 7C

Geohydrology of the Valley-Fill Aquifer in the Ramapo and Mahwah Rivers Area, Rockland County, New York,
W83-00556 7C

Hydrology and Chemical Quality of Ground Water in Kiowa County, Colorado,
W83-00561 7C

Geohydrology of the Valley-Fill Aquifer in the Jamestown Area, Chautauqua County, New York,
W83-00564 7C

Deep Oxygenated Ground Water: Anomaly or Common Occurrence.,
W83-00565 2F

Microbiology of Potable Water and Ground Water,
W83-00655 5F

Ground-Water Levels in Selected Well Fields and in West-Central Florida, September 1981,
W83-00685 7C

Aquifer Data From Four Wells in the Mendenhall Valley Near Juneau, Alaska,
W83-00686 7C

Data on Selected Deep Wells in South Florida,
W83-00689 7C

Ground-Water Quality in East-Central Idaho Valleys,
W83-00694 7C

Geohydrology of the Valley-Fill Aquifer in the Elmira Area, Chemung County, New York,
W83-00695 7C

Geohydrology of the Valley-Fill Aquifer in the Cortland-Homer-Preble Area, Cortland and Onondaga Counties, New York,
W83-00697 7C

Geohydrology of the Valley-Fill Aquifer in the Sprout and Fishkill Creeks Area, Dutchess County, New York,
W83-00698 7C

Geohydrology of the Glaciolacustrine Aquifer in the Fulton area, Oswego County, New York,
W83-00699 7C

Water Resources Data for Maryland and Delaware, Water Year 1981.
W83-00700 7C

GROUNDWATER AVAILABILITY
Groundwater Supply Exploration in Semi-Arid Regions for Livestock Extension--A Technical and Economic Appraisal,
W83-00459 6B

Availability of Water From Aquifers in Upstate New York,
W83-00681 7C

GROUNDWATER LEVEL
Predicting Depths to the Water Table in Deeply Weathered River Catchments in Nigeria,
W83-00497 2F

GROUNDWATER LEVELS
Tamarisk and River-Channel Management,
W83-00428 4A

GROUNDWATER MANAGEMENT
Beyond Section 858: A Proposed Ground-Water Liability and Management System for the Eastern United States,
W83-00439 6E

Economic Evaluation of Groundwater Policy Alternatives in the Northern Great Plains,
W83-00623 4B

GROUNDWATER MOVEMENT
Geohydrology of the Preglacial Genesee Valley, Monroe County, New York,
W83-00554 7C

Geohydrology of the Valley-Fill Aquifer in the Endicott-Johnson City Area, Broome County, New York,
W83-00555 7C

Geohydrology of the Valley-Fill Aquifer in the Ramapo and Mahwah Rivers Area, Rockland County, New York,
W83-00556 7C

Geohydrology of the Valley-Fill Aquifer in the Jamestown Area, Chautauqua County, New York,
W83-00564 7C

A Conductiometric Technique for Measuring the Water Velocity in Salmonid Spawning Beds,
W83-00644 2F

Regional Geohydrology of the Northern Louisian Salt-Dome Basin, Part I, Conceptual Model and Data Needs,
W83-00691 2F

Geohydrology of the Valley-Fill Aquifer in the Elmira Area, Chemung County, New York,
W83-00695 7C

Geohydrology of the Valley-Fill Aquifer in the Cortland-Homer-Preble Area, Cortland and Onondaga Counties, New York,
W83-00697 7C

Geohydrology of the Valley-Fill Aquifer in the Sprout and Fishkill Creeks Area, Dutchess County, New York,
W83-00698 7C

Geohydrology of the Glaciolacustrine Aquifer in the Fulton area, Oswego County, New York,
W83-00699 7C

GROUNDWATER POLLUTION
EPA and Water Supply--Present and Future,
W83-00493 5G

Contamination of a Glacial Aquifer at Pease Air Force Base, Portsmouth, New Hampshire,
W83-00495 5B

Ground-Water Pollution Investigations in the Great Ouse Basin. II-Solid Waste Disposal,
W83-00507 5B

Large Subsurface Sewage Disposal Systems,
W83-00626 5B

Monitoring to Detect Groundwater Problems Resulting From Enhanced Oil Recovery,
W83-00635 5B

Survey of On-Going and Completed Remedial Action Projects,
W83-00637 5G

Interlaboratory Testing of the Leachability of Wastes and Sludges (Ringversuche zur Bestimmung Der Eluierbarkeit Von Abfallen und Schlammen Mit Wasser),
W83-00650 5B

Sewage Plume in a Sand and Gravel Aquifer, Cape Cod, Massachusetts,
W83-00688 5B

GROUNDWATER POTENTIAL
Hydrologic Data From Test Wells and Low-Flow Investigations in the Middle Reach of the Eagle River Valley, Alaska, 1980-81,
W83-00682 7C

GROUNDWATER RECHARGE
Effect of Length of Fallow Period on Water Storage and Drainage,
W83-00618 3F

GROWTH RATES
Survival and Growth of Phytophagous Fish as a Function of Oxygen Concentration in Water,
W83-00594 5C

HARDNESS
The Effect of Water Hardness on Nitrilotriacetate Removal and Microbial Acclimation in Activated Sludge,
W83-00668 5D

HAWAII
Use of a Kinetic Study to Optimize the Activated Sludge Process,
W83-00677 5D

HAZARDOUS MATERIALS
Survey of On-Going and Completed Remedial Action Projects,
W83-00637 5G

HEAT TRANSFER
Convection in Bottom Sediments and its Role in Material Exchange Between Water and Sediments,
W83-00531 5B

HEAVY METALS
Factors Affecting the Toxic Effect of Tin on Estuarine Microorganisms,
W83-00393 5C

Metal Resistances of Chlorophyta From Rivers Polluted by Heavy Metals,
W83-00538 5C

Ecological Assessment of Water Quality in the Estuarine Region of the Danube,
W83-00602 5B

Simulation of Nutrient and Heavy Metal Transport Capacity of Suspended Sediment,
W83-00609 4D

Hydrogeochemical Prospecting of Ore-Deposits, Demonstrated on Some Water Analyses From Peru. (Hydrogeochemische Prospektion Von Erzlagerstatten Dargestellt Anhand Einiger Wasseranalysen Aus Peru),
W83-00674 5B

HERBICIDES
Effects of 2,4-D on Non-Target Species in Kerr Reservoir,
W83-00378 3B

The Use of Herbicides for Aquatic Weed Control in Water Supply Catchments,
W83-00496 3B

HETEROTROPHIC BACTERIA
Widespread Distribution of Ability to Oxidize Manganese Among Freshwater Bacteria,
W83-00390 5B

Winter Microbial Activity in Lake Tuusulanjarvi,
W83-00528 5G

The Influence of Sulphite Mill Effluents on Heterotrophic Activity as Measured by Glucose Assimilation,
W83-00536 5C

Comparison Between the Carbon-14 and Oxygen Consumption Method for the Determination of the Activity of Heterotrophic Bacterial Populations,
W83-00569 2H

HIGHWAYS
The Character and Dispersal of Motorway Run-Off Water,
W83-00461 5B

Hydrologic Effects on Highway-Deicing Chemicals in Massachusetts,
W83-00558 5B

HOLDING TANKS
Evaluation of the Performance of a Combined Sewer Overflow Retention Tank,
W83-00627 5D

HUMIC ACIDS
Dissolved Humic Materials: Photodegradation, Sediment Effects, and Reactivity with Phosphate and Calcium Carbonate Precipitation,
W83-00397 2H

Seasonal and Spatial Distribution of Humus Fractions in a Chain of Polyhumic Lakes in Southern Finland,
W83-00521 2H

HYDRAULIC DESIGN
Penstock Entrance Research- Auburn Dam Entrance,
W83-00638 8A

HYDRAULIC LOADING
Stability and Performance of Anaerobic Fixed Film Reactors During Hydraulic Overloading at 10-35C,
W83-00670 5D

HYDRAULIC MODELS
Penstock Entrance Research- Auburn Dam Entrance,
W83-00638 8A

HYDROELECTRIC POWER
Estimation of Small-Scale Hydropower Potential,
W83-00357 6A

HYDROLOGIC BUDGET
Is Evaporation an Important Component in High Alpine Hydrology.
W83-00373 2D

Effect of Scale on the Complexity of Snowmelt Systems,
W83-00375 2C

Measuring and Modelling Snowmelt in Dyrdalen, Western Norway, 1979 and 1980,
W83-00376 2C

A Computer Simulation of the Effects of Differing Crop Types on the Water Balance of Small Catchments Over Long Time Periods,
W83-00585 2D

Infiltration Formulas by Curve Number Procedure,
W83-00653 2E

HYDROLOGIC DATA
Instruments for Mountainous Areas,
W83-00361 7B

Water Resources Data for Arizona, Water Year 1980.
W83-00546 7C

Water Resources Data for Washington, Water Year 1980--Volume 2. Eastern Washington.
W83-00547 7C

Water Resources Data for Washington, Water Year 1980--Volume 1. Western Washington.
W83-00548 7C

Water Resources Data, New York, Water Year 1981--Volume 1. Eastern New York Excluding Long Island.
W83-00549 7C

Statistical Summaries of Water-Quality Data for Two Coal Areas of Jackson County, Colorado,
W83-00550 7C

January 1981 Water Levels, and Data Related to Water-Level Changes, Western and South-Central Kansas,
W83-00553 7C

Background Hydrologic Information in Potential Lignite Mining Areas in Mississippi, August 1980,
W83-00557 7C

Low-Flow Characteristics of Ohio Streams,
W83-00563 7C

Water Use in the Mississippi Gulf Coast Counties, 1980,
W83-00680 6D

Hydrologic Data From Test Wells and Low-Flow Investigations in the Middle Reach of the Eagle River Valley, Alaska, 1980-81,
W83-00682 7C

Data on Selected Deep Wells in South Florida,
W83-00689 7C

Water Resources Data for Maryland and Delaware, Water Year 1981.
W83-00700 7C

HYDROLOGIC DATA COLLECTIONS.
***WATER QUALITY**
Background Hydrologic Information in Potential Lignite Mining Areas in Mississippi, August 1981,
W83-00693 7C

HYDROLOGIC MODELS
Computer Programs for Modeling Flow and Water Quality of Surface Water Systems,
W83-00687 2A

HYDROLOGICAL MODELS
The IUH of General Hydrologic System Model,
W83-00652 2A

ICELAND
The Palaeolimnology of Lake Myvatn, Northern Iceland; Plant and Animal Microfossils in the Sediment,
W83-00533 2H

IDAHO
Thermal Springs in the Salmon River Basin, Central Idaho,
W83-00552 1A

Optimal Planning of Irrigation Distribution and Application Systems for a Large Irrigated Area,
W83-00616 3F

An Applied Coupled Simulation-Optimization Model of Water Use Efficiency in Intensive Fish Culture Systems,
W83-00617 8I

Ground-Water Quality in East-Central Idaho Valleys,
W83-00694 7C

IMPAIRED WATER USE
Survey of Joint US - USSR Experience in Effective Use of Saline Irrigated Lands.
W83-00606 3C

INCINERATION
A Solution to Screenings Problems by Dewatering and Incineration,
W83-00473 5D

Sludge Incineration With Energy Recovery,
W83-00608 5E

INCUBATION
Inaccuracy of the Preincubation Modified M-FC Method for Estimating Fecal Coliform Densities in Marine Waters,
W83-00491 5A

INDIA
The Ganges Basin and the Water Dispute,
W83-00455 4A

INDICATORS
Fundamental Principles of the Comparative Toxicological Experiment,
W83-00603 5C

INDUSTRIAL WASTES
Pollution From US Explosives and Propellants Production,
W83-00441 5D

Power Industry Wastes,
W83-00657 5G

INDUSTRIAL WASTEWATER
Effect of Industrial-Residential Zones on Water Quality of Surface Streams,
W83-00460 5B

Waybill System is a Key to Industrial Waste Management and Disposal,
W83-00611 5G

Development of Analytical Test Procedures for Organic Pollutants in Wastewater - Application to Pesticides,
W83-00632 5A

INDUSTRIAL WATER
Industry,
W83-00542 6D

INFILTRATION
Infiltration Formulas by Curve Number Procedure,
W83-00653 2E

INSECTICIDES
Kepone Distribution in Selected Tissues of Blue Crabs, Callinectes Sapidus, Collected From the James River and Lower Chesapeake Bay,
W83-00436 5B

Fate of Fenitrothion in Aquatic Microcosms and the Role of Aquatic Plants,
W83-00448 5B

Mains Infestation Control Using Permethrin,
W83-00498 5F

INSTREAM FLOW
Protecting Streamflows in California,
W83-00425 6E

INTAKES
An Analysis of Mesh Sizes Required for Screening Fishes at Water Intakes,
W83-00450 8I

INTERAGENCY COOPERATION
National Acid Precipitation Assessment Plan.
W83-00607 5G

INTERCEPTION LOSS
A Computer Simulation of the Effects of Differing Crop Types on the Water Balance of Small Catchments Over Long Time Periods,
W83-00585 2D

INTERNATIONAL AGREEMENTS
The Ganges Basin and the Water Dispute,
W83-00455 4A

INTERNATIONAL COMMISSIONS
Survey of Joint US - USSR Experience in Effective Use of Saline Irrigated Lands.
W83-00606 3C

INTERSTITIAL WATER
Extraction and Analysis of Interstitial Water From Sandstone,
W83-00382 5A

INVERTEBRATES
Intertidal Community Offshore from the Werribee Sewage-Treatment Farm: An Opportunistic Infaunal Assemblage,
W83-00409 5C

ION EXCHANGE
Cation-Exchange Behaviour of a Range of Adsorbents and Chromatographic Supports With Regard to Their Suitability for Investigating Trace Metal S peciation in Natural Waters,
W83-00517 5A

IOWA
New DEQ Water Policy More Receptive to City Needs,
W83-00423 5F

Site Evaluation, Design, Operation, and Installation of Home Sewage Systems in Iowa,
W83-00621 5D

Development of a Countywide Model Management Organization for Wastewater,
W83-00622 5D

IRAQ
Probability of Annual Flows of the Greater Zab River,
W83-00457 2E

IRRIGATION
Agriculture,
W83-00540 3F

Irrigation in America-Today and Tomorrow,
W83-00592 3F

IRRIGATION DESIGN
Composite Performance Charts for Drip Irrigation Tubing,
W83-00589 3F

IRRIGATION EFFECTS
Drip vs. Flood--Viticulture Research: A Comparison of Two Irrigation Systems in California Vineyards,
W83-00588 3F

IRRIGATION EFFICIENCY
Drip vs. Flood--Viticulture Research: A Comparison of Two Irrigation Systems in California Vineyards,
W83-00588 3F

Wasting Water,
W83-00590 3F

Drip Tested on Florida Ornamentals, Evaluation of Drip Irrigation for Container Production of Woody Landscape Plants,
W83-00591 3F

Optimal Planning of Irrigation Distribution and Application Systems for a Large Irrigated Area,
W83-00616 3F

IRRIGATION PRACTICES
Survey of Joint US - USSR Experience in Effective Use of Saline Irrigated Lands.
W83-00606 3C

Improvement of Irrigation Scheduling Techniques for Corn With Variable Corn Maturity Range, Plant Population and Water Supply Availability,
W83-00624 3F

IRRIGATION PROGRAMS
Development Process for Improving Irrigation Water Management,
W83-00458 3F

IRRIGATION SCHEDULING
Improvement of Irrigation Scheduling Techniques for Corn With Variable Corn Maturity Range, Plant Population and Water Supply Availability,
W83-00624 3F

ISOTOPE STUDIES
Environmental Isotope Studies of an Alpine Snowpack,
W83-00360 2C

Isotope Input Into Runoff Systems From Melting Snow Covers,
W83-00374 2C

IVORY COAST
Excretion of Dissolved Organic Phosphorus in Tropical Brackish Waters,
W83-00419 2L

JUNCUS
A Note on the Relocation of Marsh Debris During a Storm Surge,
W83-00422 2L

JURISDICTION
Paleface, Redskin, and the Great White Chiefs in Washington: Drawing the Battle Lines Over Western Water Rights,
W83-00584 6E

KANSAS
January 1981 Water Levels, and Data Related to Water-Level Changes, Western and South-Central Kansas,
W83-00553 7C

Effect of Length of Fallow Period on Water Storage and Drainage,
W83-00618 3F

KARST
Remedial Treatment Exploration, Wolf Creek Dam, KY,
W83-00651 8E

KENTUCKY
Remedial Treatment Exploration, Wolf Creek Dam, KY,
W83-00651 8E

KEPONE
Kepone Distribution in Selected Tissues of Blue Crabs, Callinectes Sapidus, Collected From the James River and Lower Chesapeake Bay,
W83-00436 5B

KERR RESERVOIR
Effects of 2,4-D on Non-Target Species in Kerr Reservoir,
W83-00378 3B

KINETICS
Stability of Chlorine Dioxide in Aqueous Solution,
W83-00667 5D

Use of a Kinetic Study to Optimize the Activated Sludge Process,
W83-00677 5D

LABORATORIES
Water Engineering Research at Swindon.
W83-00469 5F

LAGOONS
Observations on Nitrate, Phosphate and Silicate in Cleveland Bay, Northern Queensland,
W83-00406 5A

Lagoons and Oxidation Ponds,
W83-00485 5D

LAKE BAIKAL
Biodegradation of Cellulose in Bottom Sediments of Lake Baikal,
W83-00600 5B

Interaction of Bacterial Plankton and Zooplankton in Oligotrophic Water Bodies,
W83-00648 2H

LAKE ERIE
Lake Erie Cladophora in Perspective,
W83-00661 2H

LAKE HURON
Ecological Studies and Mathematical Modeling of Cladophora in Lake Huron: 3. The Dependence of Growth Rates on Internal Phosphorus Pool Size,
W83-00662 2H

LAKE MANAGEMENT
Limnological Research Can Improve and Reduce the Cost of Monitoring and Control of Water Quality,
W83-00526 5G

LAKE MENDOTA
Assessing Biomass and Production of Bacteria in Eutrophic Lake Mendota, Wisconsin,
W83-00384 2H

LAKE MICHIGAN
Sorption of Zinc by Lake Michigan Sediments--Implications for Zinc Water Quality Criteria Standards,
W83-00643 5B

LAKE MOHAVE
Primary Productivity and Nutrient Balance in a Lower Colorado River Reservoir,
W83-00394 2H

LAKE MORPHOLOGY
An Index of Littoral Zone Complexity and Its Measurement,
W83-00414 2H

Steady-State Ecosystem Modeling for Lake Management,
W83-00610 5G

LAKE RESTORATION
Winter Microbial Activity in Lake Tuusulanjarvi,
W83-00528 5G

LAKE SEDIMENTS
Assessing Biomass and Production of Bacteria in Eutrophic Lake Mendota, Wisconsin,
W83-00384 2H

Biodegradation of Cellulose in Bottom Sediments of Lake Baikal,
W83-00600 5B

Sorption of Zinc by Lake Michigan Sediments--Implications for Zinc Water Quality Criteria Standards,
W83-00643 5B

LAKE WINGRA
Biology, Metabolism and Functions of Littoral Submersed Weedbeds of Lake Wingra, Wisconsin, USA: A Summary and Review,
W83-00351 2H

LAKES
Trace Metal Speciation in Three Victorian Lakes,
W83-00412 5A

Chlorobenzenes in Sediments, Water, and Selected Fish From Lakes Superior, Huron, Erie, and Ontario,
W83-00444 5B

Eutrophication,
W83-00477 5C

The Eutrophication of Cayuga Lake: A Historical Analysis of the Phytoplankton's Response to Phosphate Detergents,
W83-00509 5C

An Oxygen Model for Lake Haukivesi,
W83-00525 5C

The Seasonal Cycle of Inorganic Carbon Species in Cazenovia Lake, New York, 1977,
W83-00532 2H

Changes in Submersed Macrophytes in Chautauqua Lake, 1937-1975,
W83-00535 2H

The Role of Nitrogen as a Growth Limiting Factor in the Eutrophic Lake Vesijarvi, Southern Finland,
W83-00604 2H

Lake Erie Cladophora in Perspective,
W83-00661 2H

Ecological Studies and Mathematical Modeling of Cladophora in Lake Huron: 3. The Dependence of Growth Rates on Internal Phosphorus Pool Size,
W83-00662 2H

LAND DISPOSAL
Rapid Infiltration Treatment of Primary and Secondary Effluents,
W83-00358 5D

Fate of Virus in Wastewater Applied to Slow-Infiltration Land Treatment Systems,
W83-00386 5B

Effect of Liquid Wastewater Sludge Application on Crop Yield and Water Quality,
W83-00656 5E

Sewage Plume in a Sand and Gravel Aquifer, Cape Cod, Massachusetts,
W83-00688 5B

LAND USE
The Effect of Land Use on the Diatom Communities in Lakes,
W83-00530 5C

LANDFILLS
Composting Sewage Sludge by Means of Forced Aeration,
W83-00614 5E

LANDSCAPING
Wasting Water,
W83-00590 3F

LARGE WATERSHEDS
Practical Application of Linear Programming and Network Flows - Proceedings of the Technology Transfer Workshop.
W83-00628 6A

LEACHATES
Ground-Water Pollution Investigations in the Great Ouse Basin. II-Solid Waste Disposal,
W83-00507 5B

LEACHING
Organic and Organotin Compounds Leached From PVC and CPVC Pipe,
W83-00633 5F

Interlaboratory Testing of the Leachability of Wastes and Sludges (Ringversuche zur Bestimmung Der Eluierbarkeit Von Abfallen und Schlammen Mit Wasser),
W83-00650 5B

LEAD
Use of a Hydride-Generation Technique for the Atomic Absorption Determination of Lead in Drinking Water,
W83-00401 5A

LEAST SQUARES METHOD
Self-Consistent Least-Squares Method of Estimating Chemical Composition of the Sources of Chemical Constituents in Natural Waters,
W83-00353 2K

LEGAL ASPECTS
Protecting Streamflows in California,
W83-00425 6E

Beyond Section 858: A Proposed Ground-Water Liability and Management System for the Eastern United States,
W83-00439 6E

East is West and West is West: Have the Twain Met.,
W83-00464 6E

Oil Spill Cleanup Fulfills Aim of Federal Water Pollution Control Act,
W83-00566 5G

'Plain Meaning' Decision Clarifies Standard for Effluent Limitations,
W83-00567 6E

Colorado Water Rights - An Engineer's Case Studies,
W83-00675 6E

LEGAL REVIEW
An Economic Evaluation of Citizen Suits,
W83-00619 6E

LEGISLATION
National Drinking Water Advisory Council and Water Utility Council: What Do They Do.,
W83-00503 5G

LETHAL LIMIT
Fundamental Principles of the Comparative Toxicological Experiment,
W83-00603 5C

LIABILITY
Beyond Section 858: A Proposed Ground-Water Liability and Management System for the Eastern United States,
W83-00439 6E

An Economic Evaluation of Citizen Suits,
W83-00619 6E

Legal Liability of Reclaimed Water System Proprietors,
W83-00620 6E

LIGHT INTENSITY
Ecological Consequences of Long-Term Exposure of Anabaena Variabilis (Cyanophyceae) to Shifts in Environmental Factors,
W83-00391 5C

LIGHT PENETRATION
The Effect of Saline Seeps and Restricted Light Upon the Seasonal Dynamics of Phytoplankton Communities Within a Southwestern (USA) Desert Canyon Stream,
W83-00398 2K

LIGNITE
Background Hydrologic Information in Potential Lignite Mining Areas in Mississippi, August 1980,
W83-00557 7C

Background Hydrologic Information in Potential Lignite Mining Areas in Mississippi, August 1981,
W83-00693 7C

LIME
Lime in Wastewater Treatment,
W83-00427 5D

LINEAR PROGRAMMING
Practical Application of Linear Programming and Network Flows - Proceedings of the Technology Transfer Workshop.
W83-00628 6A

LIPIDS
Factors Limiting Emulsified Lipid Treatment Capacity of Activated Sludge,
W83-00499 5D

LIQUEFACTION
Physical and Chemical Characteristics of Synthetic Asphalt Produced From Liquefaction of Sewage Sludge,
W83-00636 5E

LITERATURE REVIEW
Eutrophication,
W83-00477 5C

Mixing and Transport,
W83-00478 5B

Non-Point Sources,
W83-00479 5B

Denitrification,
W83-00480 5D

Operation and Maintenance of Wastewater Systems Including Instrumentation and Automation,
W83-00481 5D

Onsite Alternatives for Treatment and Disposal,
W83-00482 5D

Sludge Treatment, Utilization, and Disposal,
W83-00483 5E

Biological Filters,
W83-00484 5D

Lagoons and Oxidation Ponds,
W83-00485 5D

Physical and Chemical Methods,
W83-00486 5D

Disinfection,
W83-00487 5F

Continuous Monitoring, Automated Analysis, and Sampling Procedures,
W83-00488 5A

LITERATURE REVIEWS
Microbiology of Potable Water and Ground Water,
W83-00655 5F

Power Industry Wastes,
W83-00657 5G

Microbiology: Detection of Bacterial Pathogens and Their Occurrence,
W83-00658 5A

LITTORAL ZONE
Biology, Metabolism and Functions of Littoral Submersed Weedbeds of Lake Wingra, Wisconsin, USA: A Summary and Review,
W83-00351 2H

An Index of Littoral Zone Complexity and Its Measurement,
W83-00414 2H

Carbon, Phosphorus and Nitrogen Budgets of the Littoral Equisetum Belt in an Oligotrophic Lake,
W83-00522 2H

LONG-TERM PLANNING
Energy,
W83-00543 6C

LONG-TERN PLANNING
Steady-State Ecosystem Modeling for Lake Management,
W83-00610 5G

LOUISANA
Regional Geohydrology of the Northern Louisian Salt-Dome Basin, Part I, Conceptual Model and Data Needs,
W83-00691 2F

LOUISIANA
Destruction of Pollutants in Water With Ozone in Combination With Ultraviolet Radiation. 2. Natural Trihalomethane Precursors,
W83-00445 5F

LOW FLOW
Low-Flow Characteristics of Ohio Streams,
W83-00563 7C

Hydrologic Data From Test Wells and Low-Flow Investigations in the Middle Reach of the Eagle River Valley, Alaska, 1980-81,
W83-00682 7C

MACROPHYTES
Growth and Recession of Aquatic Macrophytes on a Shaded Section of the River Lambourn, England, From 1971 to 1980,
W83-00520 2I

Carbon, Phosphorus and Nitrogen Budgets of the Littoral Equisetum Belt in an Oligotrophic Lake,
W83-00522 2H

Changes in Submersed Macrophytes in Chautauqua Lake, 1937-1975,
W83-00535 2H

Phytophilous Assemblages of Organisms in Saratov Reservoir,
W83-00579 2H

MAINTENANCE
Operation and Maintenance of Wastewater Systems Including Instrumentation and Automation,
W83-00481 5D

MANGANESE
Widespread Distribution of Ability to Oxidize Manganese Among Freshwater Bacteria,
W83-00390 5B

The Forms in Which Manganese Migrates in the Water of the Dnieper and the Desna,
W83-00601 5B

MAPS
Availability of Water From Aquifers in Upstate New York,
W83-00681 7C

Ground-Water Levels in Selected Well Fields and in West-Central Florida, September 1981,
W83-00685 7C

MARINE BACTERIA
Diluent Composition for Use of API 20E in Characterizing Marine and Estuarine Bacteria,
W83-00388 5A

MARKET VALUE
Industry,
W83-00542 6D

MARSH MANAGEMENT
Coastal Zone Development: Mitigation, Marsh Creation, and Decision-Making,
W83-00430 6G

MARSH PLANTS
A Comparative Analysis of the C02 and Water Vapor Responses of Two Spartina Species From Georgia Coastal Marshes,
W83-00421 2I

A Note on the Relocation of Marsh Debris During a Storm Surge,
W83-00422 2L

MARSHES
Hydrobiological Studies of Eastern Lesser Antillean Islands VII. St. Lucia: Behavioural Drift and Other Movements of Freshwater Marsh Molluscs,
W83-00395 5B

Microbial Metabolism of Acetate, Propionate, and Butyrate in Anoxic Sediment From the Colne Point Saltmarsh, Essex, U.K.,
W83-00519 2L

MARYLAND
Factors Affecting the Toxic Effect of Tin on Estuarine Microorganisms,
W83-00393 5C

Water Resources Data for Maryland and Delaware, Water Year 1981.
W83-00700 7C

MASSACHUSETTS
Hydrologic Effects on Highway-Deicing Chemicals in Massachusetts,
W83-00558 5B

Sewage Plume in a Sand and Gravel Aquifer, Cape Cod, Massachusetts,
W83-00688 5B

MATHEMATICAL EQUATIONS
A Rapid, Low-Cost Technique for Estimating Peak Flow for Selected Flood Events,
W83-00613 2E

MATHEMATICAL MODELS
Survey of Joint US - USSR Experience in Effective Use of Saline Irrigated Lands.
W83-00606 3C

Optimal Planning of Irrigation Distribution and Application Systems for a Large Irrigated Area,
W83-00616 3F

Economic Evaluation of Groundwater Policy Alternatives in the Northern Great Plains,
W83-00623 4B

Large Subsurface Sewage Disposal Systems,
W83-00626 5B

Improvement of Nonlinear Rainfall-Runoff Model,
W83-00654 2A

Vertical Circulation in Density-Stratified Reservoir,
W83-00676 2H

MATHEMATICAL STUDIES
Frozen Soil Effects on the Erosion Hazard,
W83-00615 2J

The IUH of General Hydrologic System Model,
W83-00652 2A

Infiltration Formulas by Curve Number Procedure,
W83-00653 2E

MEASURING INSTRUMENTS
Instruments for Mountainous Areas,
W83-00361 7B

Abnormal Behaviour of Zeuzier Arch-Dam (Switzerland), III. Geodetic Deformation Measurements,
W83-00364 8A

Measuring and Modelling Snowmelt in Dyrdalen, Western Norway, 1979 and 1980,
W83-00376 2C

Determination of Arsenic in Synthetic Fuel Process Waters,
W83-00402 5A

Specification for Procurement of Water-Level Sensing Instrumentation, Specification Number HIF-I-1,
W83-00684 7B

MEMBRANE LININGS
Installation of Flexible Membrane Lining in Mt. Elbert Forebay Reservoir,
W83-00641 8G

MEMBRANE PROCESSES
Reverse Osmosis in an Unstirred Batch System. II. Analysis on Transport Phenomena Across Membrane,
W83-00583 3A

MESH SIZE
An Analysis of Mesh Sizes Required for Screening Fishes at Water Intakes,
W83-00450 8I

METABOLISM
Microbial Metabolism of Acetate, Propionate, and Butyrate in Anoxic Sediment From the Colne Point Saltmarsh, Essex, U.K.,
W83-00519 2L

METALS
Extraction-Spectrophotometric Determination of Copper (II) with 4-(2-Pyridylazo) Resorcinol and a Long-Chain Quaternary Ammonium Salt,
W83-00354 5A

Metal Levels in the Mussel Mytilus Edulis Collected from Estuaries in South-Eastern Australia,
W83-00411 5A

Trace Metal Speciation in Three Victorian Lakes,
W83-00412 5A

Daily Intake of Lead, Cadmium, Copper, and Zinc From Drinking Water: The Seattle Study of Trace Metal Exposure,
W83-00431 5B

Components of Variation in Lead, Cadmium, Copper, and Zinc Concentration in Home Drinking Water: The Seattle Study of Trace Metal Exposure,
W83-00432 5A

Evaluating the Potential for Contaminating Drinking Water From the Corrosion of Tin-Antimony Solder,
W83-00452 5B

Effect of Industrial-Residential Zones on Water Quality of Surface Streams,
W83-00460 5B

Removing Metals From Waste Solutions With Low Rank Coals and Related Materials,
W83-00471 5D

The Main Approaches to the Study of the Cycle of Biological Elements in the Dnieper Reservoirs,
W83-00599 5B

METROPOLITAN WATER MANAGEMENT
New DEQ Water Policy More Receptive to City Needs,
W83-00423 5F

Analysis of Water Supply Costs in the Washington (D.C.) Area,
W83-00467 6B

MEXICO
The Density and Composition of Hypersaline Waters of a Mexican Lagoon,
W83-00572 2K

MICHIGAN
Dissolved Humic Materials: Photodegradation, Sediment Effects, and Reactivity with Phosphate and Calcium Carbonate Precipitation,
W83-00397 2H

MICROBIOLOGICAL STUDIES
Investigation on the Microbiology of the Saar River (Untersuchung Zur Microbiologie Der Saar),
W83-00649 5B

Microbiology of Potable Water and Ground Water,
W83-00655 5F

MICROORGANISMS
Factors Affecting the Toxic Effect of Tin on Estuarine Microorganisms,
W83-00393 5C

Destruction of Organic Matter by Higher Water Plants Under Experimental Conditions,
W83-00597 2H

MIDGES
Some Effects of Organic Pollution on the Distribution and Seasonal Incidence of Chironomidae in Riffles in the River Cole,
W83-00539 5C

MINERALIZATION
Comparison Between the Carbon-14 and Oxygen Consumption Method for the Determination of the Activity of Heterotrophic Bacterial Populations,
W83-00569 2H

MINNESOTA
Effect of Liquid Wastewater Sludge Application on Crop Yield and Water Quality,
W83-00656 5E

MISSISSIPPI
A Note on the Relocation of Marsh Debris During a Storm Surge,
W83-00422 2L

Background Hydrologic Information in Potential Lignite Mining Areas in Mississippi, August 1980,
W83-00557 7C

Water Use in the Mississippi Gulf Coast Counties, 1980,
W83-00680 6D

Background Hydrologic Information in Potential Lignite Mining Areas in Mississippi, August 1981,
W83-00693 7C

MISSOURI RIVER
Evaluation of the River Die-Away Biodegradation Test,
W83-00492 5B

MIXING
Self-Consistent Least-Squares Method of Estimating Chemical Composition of the Sources of Chemical Constituents in Natural Waters,
W83-00353 2K

Dynamics of Mixing in Estuaries,
W83-00420 2L

Mixing and Transport,
W83-00478 5B

Evaluation and Comparison of Digester Gas Mixing Systems,
W83-00500 5D

MODEL STUDIES
Eutrophication,
W83-00477 5C

Mixing and Transport,
W83-00478 5B

Steady-State Ecosystem Modeling for Lake Management,
W83-00610 5G

Comparative Evaluation of Mathematic Models Used for Calculating Aeration Tanks,
W83-00672 5D

Vertical Circulation in Density-Stratified Reservoir,
W83-00676 2H

MOLLUSKS
Hydrobiological Studies of Eastern Lesser Antillean Islands VII. St. Lucia: Behavioural Drift and Other Movements of Freshwater Marsh Molluscs,
W83-00395 5B

MONITORING
Abnormal Behaviour of Zeuzier Arch-Dam (Switzerland), III. Geodetic Deformation Measurements,
W83-00364 8A

Abnormal Behaviour of Zeuzier Arch-Dam (Switzerland) VII. Programs for Refilling and Monitoring,
W83-00368 8A

Water Quality Monitoring: What Directions Should New Programs Take,
W83-00429 5A

Biological Surveillance of Rivers,
W83-00472 5A

Limnological Research Can Improve and Reduce the Cost of Monitoring and Control of Water Quality,
W83-00526 5G

An Evaluation of Water-Quality Monitoring in the Brandywine Creek Basin, Pennsylvania, 1973-78,
W83-00560 7C

Monitoring to Detect Groundwater Problems Resulting From Enhanced Oil Recovery,
W83-00635 5B

MORPHOLOGY
Electron Microscopic Investigation of Microorganisms in Waters of Different Color,
W83-00575 2H

MOUNTAINS
Evapotranspiration at Two Mountain Sites During the Vegetation Period,
W83-00352 2D

Instruments for Mountainous Areas,
W83-00361 7B

Accuracy of Snowmelt Runoff Simulation,
W83-00370 2C

MULTIOBJECTIVE PLANNING
Optimal Planning of Irrigation Distribution and Application Systems for a Large Irrigated Area,
W83-00616 3F

MUNICIPAL WASTEWATER
Evaluation of the Performance of a Combined Sewer Overflow Retention Tank,
W83-00627 5D

Model Protocol for the Comprehensive Evaluation of Publicly Owned Treatment Works Performance and Operation,
W83-00631 5D

MUSSELS
Metal Levels in the Mussel Mytilus Edulis Collected from Estuaries in South-Eastern Australia,
W83-00411 5A

NATIONAL PARKS
Bacterial Water Quality: Springs and Streams in the Great Smoky Mountains National Park,
W83-00426 5A

NEBRASKA
Improvement of Irrigation Scheduling Techniques for Corn With Variable Corn Maturity Range, Plant Population and Water Supply Availability,
W83-00624 3F

NEVADA
Deep Oxygenated Ground Water: Anomaly or Common Occurrence.,
W83-00565 2F

NEW ENGLAND
EPA and Water Supply--Present and Future,
W83-00493 5G

NEW HAMPSHIRE
Contamination of a Glacial Aquifer at Pease Air Force Base, Portsmouth, New Hampshire,
W83-00495 5B

Design and Construction of the Pennichuck Water Treatment Plant: The Owner's View,
W83-00502 5F

NEW JERSEY
Flood Data in West Windsor Township, Mercer County, New Jersey Through 1981 Water Year,
W83-00690 7C

NEW YORK
The Eutrophication of Cayuga Lake: A Historical Analysis of the Phytoplankton's Response to Phosphate Detergents,
W83-00509 5C

The Seasonal Cycle of Inorganic Carbon Species in Cazenovia Lake, New York, 1977,
W83-00532 2H

Changes in Submersed Macrophytes in Chautauqua Lake, 1937-1975,
W83-00535 2H

Water Resources Data, New York, Water Year 1981--Volume 1. Eastern New York Excluding Long Island.
W83-00549 7C

Geohydrology of the Preglacial Genesee Valley, Monroe County, New York,
W83-00554 7C

Geohydrology of the Valley-Fill Aquifer in the Endicott-Johnson City Area, Broome County, New York,
W83-00555 7C

NEW YORK

Geohydrology of the Valley-Fill Aquifer in the Ramapo and Mahwah Rivers Area, Rockland County, New York,
W83-00556 7C

Geohydrology of the Valley-Fill Aquifer in the Jamestown Area, Chautauqua County, New York,
W83-00564 7C

Cost-Effective Program for Combined Sewer Overflow Abatement,
W83-00659 5G

Geohydrology of the Valley-Fill Aquifer in the Elmira Area, Chemung County, New York,
W83-00695 7C

Geohydrology of the Valley-Fill Aquifer in the Cortland-Homer-Preble Area, Cortland and Onondaga Counties, New York,
W83-00697 7C

Geohydrology of the Valley-Fill Aquifer in the Sprout and Fishkill Creeks Area, Dutchess County, New York,
W83-00698 7C

Geohydrology of the Glaciolacustrine Aquifer in the Fulton area, Oswego County, New York,
W83-00699 7C

NEW ZEALAND
Low Flow Water Chemistry in Forested and Pasture Catchments, Mawheraiti River, Westland,
W83-00568 5B

NICKEL
The Concentration, Reactivity and Fate of Copper, Nickel and Zinc Associated with a Cooling-Water Plume in Estuarine Waters,
W83-00443 5B

NIGERIA
Predicting Depths to the Water Table in Deeply Weathered River Catchments in Nigeria,
W83-00497 2F

The Annual Flood Regime as a Regulatory Mechanism for Phytoplankton Production in Kainji Lake, Nigeria,
W83-00529 2H

NITRILOTRIACETIC ACID
The Effect of Water Hardness on Nitrilotriacetate Removal and Microbial Acclimation in Activated Sludge,
W83-00668 5D

NITROCELLULOSE
Pollution From US Explosives and Propellants Production,
W83-00441 5D

NITROGEN
Phosphorus and Nitrogen Loads in Waters Associated with River Murray Near Albury-Wodonga, and Their Effects on Phytoplankton Populations,
W83-00410 5C

NITROGEN COMPOUNDS
Some Options for Treating Liquid Wastes From Nitrogen Fertilizer Factories,
W83-00440 5D

NITROGEN FIXATION
The Role of Nitrogen as a Growth Limiting Factor in the Eutrophic Lake Vesijarvi, Southern Finland,
W83-00604 2H

NONPOINT POLLUTION SOURCES
Non-Point Sources,
W83-00479 5B

Nonpoint-Source Pollution Control: A Resource Conservation Perspective,
W83-00665 5G

NORTH CAROLINA
Measurement of Aquatic Biodegradation Rates by Determining Heterotrophic Uptake of Radiolabeled Pollutants,
W83-00392 5B

Evaluation of Public Participation in the Yadkin-Pee Dee Level B River Basin Study,
W83-00612 6B

A Rapid, Low-Cost Technique for Estimating Peak Flow for Selected Flood Events,
W83-00613 2E

NORTHERN GREAT PLAINS
Economic Evaluation of Groundwater Policy Alternatives in the Northern Great Plains,
W83-00623 4B

NORWAY
Measuring and Modelling Snowmelt in Dyrdalen, Western Norway, 1979 and 1980,
W83-00376 2C

NUCLEAR POWERPLANTS
The Concentration, Reactivity and Fate of Copper, Nickel and Zinc Associated with a Cooling-Water Plume in Estuarine Waters,
W83-00443 5B

NUCLEAR WASTES
Desorption of Ru106, Cs134, Cs137, Ce144 and Am241 From Intertidal Sediment Contaminated by Nuclear Fuel Reprocessing Effluents,
W83-00437 5B

NUTRIENT REMOVAL
Phosphorus Reduction in a Man-Made Lake by Means of a Small Reservoir on the Inflow,
W83-00396 5G

NUTRIENT REQUIREMENTS
The Influence of River Flow on Pelagic Sardine Catches in Lake Kariba,
W83-00518 2H

NUTRIENTS
Biology, Metabolism and Functions of Littoral Submersed Weedbeds of Lake Wingra, Wisconsin, USA: A Summary and Review,
W83-00351 2H

Primary Productivity and Nutrient Balance in a Lower Colorado River Reservoir,
W83-00394 2H

Observations on Nitrate, Phosphate and Silicate in Cleveland Bay, Northern Queensland,
W83-00406 5A

Phosphorus and Nitrogen Loads in Waters Associated with River Murray Near Albury-Wodonga, and Their Effects on Phytoplankton Populations,
W83-00410 5C

Carbon, Phosphorus and Nitrogen Budgets of the Littoral Equisetum Belt in an Oligotrophic Lake,
W83-00522 2H

Nutrient Dependence of Phytoplankton Production in Brown-Water Lakes With Special Reference to Lake Paijanne,
W83-00524 5C

The Main Approaches to the Study of the Cycle of Biological Elements in the Dnieper Reservoirs,
W83-00599 5B

The Role of Nitrogen as a Growth Limiting Factor in the Eutrophic Lake Vesijarvi, Southern Finland,
W83-00604 2H

Simulation of Nutrient and Heavy Metal Transport Capacity of Suspended Sediment,
W83-00609 4D

Effect of Liquid Wastewater Sludge Application on Crop Yield and Water Quality,
W83-00656 5E

OHIO
Control of Algal Filamentous Bulking at the Southerly Wastewater Treatment Plant,
W83-00369 5D

Low-Flow Characteristics of Ohio Streams,
W83-00563 7C

OIL RECOVERY
Monitoring to Detect Groundwater Problems Resulting From Enhanced Oil Recovery,
W83-00635 5B

OIL SPILLS
Oil Spill Cleanup Fulfills Aim of Federal Water Pollution Control Act,
W83-00566 5G

OKLAHOMA
Effects of 2,4-D on Non-Target Species in Kerr Reservoir,
W83-00378 3B

OLIGOTROPHIC LAKES
Interaction of Bacterial Plankton and Zooplankton in Oligotrophic Water Bodies,
W83-00648 2H

ON-SITE INVESTIGATIONS
Onsite Alternatives for Treatment and Disposal,
W83-00482 5D

ONTARIO
An Index of Littoral Zone Complexity and Its Measurement,
W83-00414 2H

Urban Runoff Control Technology,
W83-00416 5D

Fate of Fenitrothion in Aquatic Microcosms and the Role of Aquatic Plants,
W83-00448 5B

Sludge Incineration With Energy Recovery,
W83-00608 5E

Waybill System is a Key to Industrial Waste Management and Disposal,
W83-00611 5G

Development of a Settling Model for Primary Settling Tanks,
W83-00671 5D

OPERATION
Operation and Maintenance of Wastewater Systems Including Instrumentation and Automation,
W83-00481 5D

OPTIMUM DEVELOPMENT PLANS
Optimal Planning of Irrigation Distribution and Application Systems for a Large Irrigated Area,
W83-00616 3F

ORE DEPOSITS
Hydrogeochemical Prospecting of Ore-Deposits, Demonstrated on Some Water Analyses From Peru. (Hydrogeochemische Prospektion Von Erzlagerstatten Dargestellt Anhand Einiger Wasseranalysen Aus Peru),
W83-00674 5B

OREGON
Dissolved-Oxygen and Algal Conditions in Selected Locations of the Willamette River Basin, Oregon,
W83-00696 5A

ORGANIC COMPOUNDS
Rapid Screening Technique Utilising High-Performance Liquid Chromatography for Assessing Acrylamide Contamination in Effluents,
W83-00381 5A

Determination of Selected Organics in Treated Sludges and Associated Leachates From Coal Conversion Facilities,
W83-00383 5A

Measurement of Aquatic Biodegradation Rates by Determining Heterotrophic Uptake of Radiolabeled Pollutants,
W83-00392 5B

ORGANIC MATTER
Intertidal Community Offshore from the Werribee Sewage-Treatment Farm: An Opportunistic Infaunal Assemblage,
W83-00409 5C

A Note on the Relocation of Marsh Debris During a Storm Surge,
W83-00422 2L

Organic Matter and the Surface Charge of Suspended Particles in Estuarine Waters,
W83-00573 2K

Destruction of Organic Matter by Higher Water Plants Under Experimental Conditions,
W83-00597 2H

ORGANICS SOLVENTS
Organic and Organotin Compounds Leached From PVC and CPVC Pipe,
W83-00633 5F

ORGANOCHLORINE PESTICIDES
Bioaccumulation of Organochlorines by Yearling Coho Salmon (Oncorhynchus Kisutch Walbaum) Fed Diets Containing Great Lakes' Coho Salmon, and the Pathophysiological Responses of the Recipients,
W83-00418 5C

ORGANOTIN COMPOUNDS
Organic and Organotin Compounds Leached From PVC and CPVC Pipe,
W83-00633 5F

ORNAMENTALS
Drip Tested on Florida Ornamentals, Evaluation of Drip Irrigation for Container Production of Woody Landscape Plants,
W83-00591 3F

OTTAWA RIVER BASIN
Practical Application of Linear Programming and Network Flows - Proceedings of the Technology Transfer Workshop.
W83-00628 6A

OUTFALLS
Distribution of Enteroviruses in Sediments Contiguous With a Deep Marine Sewage Outfall,
W83-00645 5B

OXIDATION
Widespread Distribution of Ability to Oxidize Manganese Among Freshwater Bacteria,
W83-00390 5B

Destruction of Pollutants in Water With Ozone in Combination With Ultraviolet Radiation. 2. Natural Trihalomethane Precursors,
W83-00445 5F

Destruction of Pollutants in Water With Ozone in Combination With Ultraviolet Radiation. 1. General Principles and Oxidation of Tetrachloroethylene,
W83-00446 5F

OXIDATION DITCHES
A Comparison of the Carrousel and Pasveer Ditch Activated Sludge Plant,
W83-00476 5D

OXIDATION PONDS
Lagoons and Oxidation Ponds,
W83-00485 5D

OXYGEN BALANCE
Ecological and Physiological Profile of Filamentous Green Algae as Factors in the Production of Organic Matter and Control of Water Quality,
W83-00576 2H

OXYGEN DEMAND
Managing Water Quality in Channel Catfish Ponds,
W83-00666 5G

OXYGEN DEPLETION
Benthic Communities in an Estuary with Periodic Deoxygenation,
W83-00407 2L

Survival and Growth of Phytophagous Fish as a Function of Oxygen Concentration in Water,
W83-00594 5C

OXYGEN UPTAKE
Comparison Between the Carbon-14 and Oxygen Consumption Method for the Determination of the Activity of Heterotrophic Bacterial Populations,
W83-00569 2H

Oxygen Consumption and Ammonia and Phosphate Excretion in Pond Zooplankton,
W83-00571 2H

OXYGENATION
Oxygen Injection Into a Rising Main: Its Effect on Pumping,
W83-00474 5D

OZONATION
Destruction of Pollutants in Water With Ozone in Combination With Ultraviolet Radiation. 2. Natural Trihalomethane Precursors,
W83-00445 5F

OZONE
Destruction of Pollutants in Water With Ozone in Combination With Ultraviolet Radiation. 1. General Principles and Oxidation of Tetrachloroethylene,
W83-00446 5F

PALEOLIMNOLOGY
The Palaeolimnology of Lake Myvatn, Northern Iceland; Plant and Animal Microfossils in the Sediment,
W83-00533 2H

PATH OF POLLUTANTS
Halocarbons as Tracer Substances in Studies of the Distribution Patterns of Chlorinated Waters in Coastal Areas,
W83-00435 5B

Regional Geohydrology of the Northern Louisian Salt-Dome Basin, Part I, Conceptual Model and Data Needs,
W83-00691 2F

PATHOGENS
Amoebae From Antarctic Soil and Water,
W83-00389 5A

Microbiology: Detection of Bacterial Pathogens and Their Occurrence,
W83-00658 5A

PELAGIC ZONE
Distribution of Littoral Crustaceans in the Pelagic Zone of Lake Glubokoye,
W83-00595 2H

PENNSYLAVANIA
An Evaluation of Water-Quality Monitoring in the Brandywine Creek Basin, Pennsylavania, 1973-78,
W83-00560 7C

PENNSYLVANIA
A Stormwater Management Model for the West Branch Brandywine Creek, Chester County, Pennsylvania,
W83-00562 4A

PENSTOCKS
Penstock Entrance Research- Auburn Dam Entrance,
W83-00638 8A

PERCH
Accumulation by Fish of Contaminants Released From Dredged Sediments,
W83-00449 5B

The Response of a Perch, Perca Fluviatilis L., Population to Eutrophication and Associated Changes in Fish Fauna in a Small Lake,
W83-00678 5C

PERCOLATION
Application of the Gravity Flow Theory to the Percolation of Melt Water Through Firn,
W83-00513 2C

PERFORMANCE EVALUATION
Composite Performance Charts for Drip Irrigation Tubing,
W83-00589 3F

Model Protocol for the Comprehensive Evaluation of Publicly Owned Treatment Works Performance and Operation,
W83-00631 5D

Performance of Trickling Filter Plants: Reliability, Stability and Variability,
W83-00634 5D

PERMETHRIN
Mains Infestation Control Using Permethrin,
W83-00498 5F

PERMITS
Adjudicatory Hearings as Part of the NPDES Hearing Process,
W83-00424 6E

PERU
Hydrogeochemical Prospecting of Ore-Deposits, Demonstrated on Some Water Analyses From Peru. (Hydrogeochemische Prospektion Von Erzlagerstatten Dargestellt Anhand Einiger Wasseranalysen Aus Peru),
W83-00674 5B

PESTICIDE TOXICITY
Effects of 2,4-D on Non-Target Species in Kerr Reservoir,
W83-00378 3B

PESTICIDES
Bioaccumulation of Organochlorines by Yearling Coho Salmon (Oncorhynchus Kisutch Walbaum) Fed Diets Containing Great Lakes' Coho Salmon, and the Pathophysiological Responses of the Recipients,
W83-00418 5C

Development of Analytical Test Procedures for Organic Pollutants in Wastewater - Application to Pesticides,
W83-00632 5A

PHOSPHATES
Solvent Extraction of Molybdophosphate with Cationic Dyes and Spectrophotometric Determination of Micro Amounts of Phosphate in Waters,
W83-00355 5A

PHOSPHATES

Dissolved Humic Materials: Photodegradation, Sediment Effects, and Reactivity with Phosphate and Calcium Carbonate Precipitation,
W83-00397 2H

PHOSPHORUS

Indirect Determination of Sub-ng Per ml-1 Levels of Phosphorus in Waters by Di-Isobutyl Ketone Extraction of Reduced Molybdoantimonylphosphoric Acid and Inductively-Coupled Plasma Emission Spectrometry,
W83-00380 5A

Phosphorus Export from Coastal Plain Drainage Into the Peel-Harvey Estuarine System of Western Australia,
W83-00408 5B

Phosphorus and Nitrogen Loads in Waters Associated with River Murray Near Albury-Wodonga, and Their Effects on Phytoplankton Populations,
W83-00410 5C

Excretion of Dissolved Organic Phosphorus in Tropical Brackish Waters,
W83-00419 2L

Nutrient Dependence of Phytoplankton Production in Brown-Water Lakes With Special Reference to Lake Paijanne,
W83-00524 5C

Ecological Studies and Mathematical Modeling of Cladophora in Lake Huron: 3. The Dependence of Growth Rates on Internal Phosphorus Pool Size,
W83-00662 2H

PHREATOPHYTES

Tamarisk and River-Channel Management,
W83-00428 4A

Evapotranspiration From Riparian Vegetation: Water Relations and Irrecoverable Losses for Saltcedar,
W83-00663 3B

Evapotranspiration From Riparian Vegetation: Conserving Water by Reducing Saltcedar Transpiration,
W83-00664 3B

PHTHALATES

Phthalate Ester Concentration Variations in Dated Sediment Cores From the Chesapeake Bay,
W83-00434 5B

Evaluation of the River Die-Away Biodegradation Test,
W83-00492 5B

PHYSICAL PROPERTIES

Thermal Springs in the Salmon River Basin, Central Idaho,
W83-00552 1A

Vertical Circulation in Density-Stratified Reservoir,
W83-00676 2H

PHYSICOCHEMICAL TREATMENT

Physical and Chemical Methods,
W83-00486 5D

PHYTOPLANKTON

Primary Productivity and Nutrient Balance in a Lower Colorado River Reservoir,
W83-00394 2H

Phosphorus Reduction in a Man-Made Lake by Means of a Small Reservoir on the Inflow,
W83-00396 5G

The Effect of Saline Seeps and Restricted Light Upon the Seasonal Dynamics of Phytoplankton Communities Within a Southwestern (USA) Desert Canyon Stream,
W83-00398 2K

Phosphorus and Nitrogen Loads in Waters Associated with River Murray Near Albury-Wodonga, and Their Effects on Phytoplankton Populations,
W83-00410 5C

Nutrient Dependence of Phytoplankton Production in Brown-Water Lakes With Special Reference to Lake Paijanne,
W83-00524 5C

The Annual Flood Regime as a Regulatory Mechanism for Phytoplankton Production in Kainji Lake, Nigeria,
W83-00529 2H

The Influence of Sulphite Mill Effluents on Heterotrophic Activity as Measured by Glucose Assimilation,
W83-00536 5C

High Frequency Endogenous Periodicities of Chlorophyll Synthesis in Estuarine Phytoplankton,
W83-00570 2L

Phytoplankton of the Yenisey Bay,
W83-00577 2L

Diel Dynamics of Phytoplankton in Lake Kandry-Kul,
W83-00578 2H

Dispersion Patterns of Phytoplankton in Lakes,
W83-00581 2H

The Role of Nitrogen as a Growth Limiting Factor in the Eutrophic Lake Vesijarvi, Southern Finland,
W83-00604 2H

Seasonal Succession of Phytoplankton in an Ice-Free Pond Warmed by a Thermal Power Plant,
W83-00605 5C

PIPING PHENOMENA

Remedial Treatment Exploration, Wolf Creek Dam, KY,
W83-00651 8E

PIPING POTENTIAL

Piping Potential of Weak Zones Under Concrete Dams,
W83-00356 8A

PLANKTON

Excretion of Dissolved Organic Phosphorus in Tropical Brackish Waters,
W83-00419 2L

PLANNING

Water Resources and Environmental Planning Using Interactive Graphics,
W83-00456 6A

Analysis of Water Supply Costs in the Washington (D.C.) Area,
W83-00467 6B

Design and Construction of the Pennichuck Water Treatment Plant: The Owner's View,
W83-00502 5F

PLASTIC PIPES

Organic and Organotin Compounds Leached From PVC and CPVC Pipe,
W83-00633 5F

PLASTICS

The Construction of the Marchwiel Reservoir Using a High Density Polyethylene Lining,
W83-00504 8G

PLAYAS

Physical and Chemical Features of Playa Lakes in Southeastern California, USA,
W83-00372 2H

PLUMBING

Daily Intake of Lead, Cadmium, Copper, and Zinc From Drinking Water: The Seattle Study of Trace Metal Exposure,
W83-00431 5B

Evaluating the Potential for Contaminating Drinking Water From the Corrosion of Tin-Antimony Solder,
W83-00452 5B

POLLUTANT IDENTIFICATION

Extraction-Spectrophotometric Determination of Copper (II) with 4-(2-Pyridylazo) Resorcinol and a Long-Chain Quaternary Ammonium Salt,
W83-00354 5A

Solvent Extraction of Molybdophosphate with Cationic Dyes and Spectrophotometric Determination of Micro Amounts of Phosphate in Waters,
W83-00355 5A

Indirect Determination of Sub-ng Per ml-1 Levels of Phosphorus in Waters by Di-Isobutyl Ketone Extraction of Reduced Molybdoantimonylphosphoric Acid and Inductively-Coupled Plasma Emission Spectrometry,
W83-00380 5A

Rapid Screening Technique Utilising High-Performance Liquid Chromatography for Assessing Acrylamide Contamination in Effluents,
W83-00381 5A

Diluent Composition for Use of API 20E in Characterizing Marine and Estuarine Bacteria,
W83-00388 5A

Use of a Hydride-Generation Technique for the Atomic Absorption Determination of Lead in Drinking Water,
W83-00401 5A

Determination of Arsenic in Synthetic Fuel Process Waters,
W83-00402 5A

Influence of Valence State on the Determination of Antimony, Arsenic, Bismuth, Selenium and Tellurium in Lake Water Using the Hydride AA Technique,
W83-00403 5A

Determination of Dissolved Selenium in Fresh and Estuarine Waters by Flameless Atomic Absorption,
W83-00404 5A

Determination of Arsenic in Potable, Fresh and Estuarine Water by Flameless Atomic Absorption,
W83-00405 5A

Metal Levels in the Mussel Mytilus Edulis Collected from Estuaries in South-Eastern Australia,
W83-00411 5A

Trace Metal Speciation in Three Victorian Lakes,
W83-00412 5A

Components of Variation in Lead, Cadmium, Copper, and Zinc Concentration in Home Drinking Water: The Seattle Study of Trace Metal Exposure,
W83-00432 5A

Halocarbons as Tracer Substances in Studies of the Distribution Patterns of Chlorinated Waters in Coastal Areas,
W83-00435 5B

Determining Free Available Chlorine by DPD-Colorimetric, DPD-Steadifac (Colorimetric), and Facts Procedures,
W83-00453 5A

Biological Surveillance of Rivers,
W83-00472 5A

Continuous Monitoring, Automated Analysis, and Sampling Procedures,
W83-00488 5A

Inaccuracy of the Preincubation Modified M-FC Method for Estimating Fecal Coliform Densities in Marine Waters,
W83-00491 5A

An Automatic Voltammetric Analyzer for the Simultaneous Determination of Toxic Trace Metals in Water,
W83-00510 7B

Cation-Exchange Behaviour of a Range of Adsorbents and Chromatographic Supports With Regard to Their Suitability for Investigating Trace Metal S peciation in Natural Waters,
W83-00517 5A

Chemiluminescence Method for the Determination of Trace Amounts of Proteins in Natural Waters,
W83-00580 5A

Ra-228, Ra-226, Rn-222, in South Carolina Ground Water: Measurement Techniques and Isotope Relationships,
W83-00625 5A

The Use of Uric Acid as a Method of Tracing Domestic Sewage Discharges in Riverine, Estuarine and Coastal Water Environments,
W83-00646 5A

POLYCHLORINATED BIPHENYLS
Accumulation by Fish of Contaminants Released From Dredged Sediments,
W83-00449 5B

POLYETHYLENE
The Construction of the Marchwiel Reservoir Using a High Density Polyethylene Lining,
W83-00504 8G

POLYVINYL CHLORIDE
Organic and Organotin Compounds Leached From PVC and CPVC Pipe,
W83-00633 5F

POPULATION DYNAMICS
Growth and Recession of Aquatic Macrophytes on a Shaded Section of the River Lambourn, England, From 1971 to 1980,
W83-00520 2I

Municipal and Domestic Use,
W83-00541 6D

POTABLE WATER
Microbiology of Potable Water and Ground Water,
W83-00655 5F

POTENTIOMETRIC LEVEL
Ground-Water Levels in Selected Well Fields and in West-Central Florida, September 1981,
W83-00685 7C

POWERPLANTS
Power Industry Wastes,
W83-00657 5G

PREDICTION
Predicting Depths to the Water Table in Deeply Weathered River Catchments in Nigeria,
W83-00497 2F

PRIMARY PRODUCTIVITY
Primary Productivity and Nutrient Balance in a Lower Colorado River Reservoir,
W83-00394 2H

PRIMARY WASTEWATER TREATMENT
Development of a Settling Model for Primary Settling Tanks,
W83-00671 5D

PRODUCTIVITY
Nutrient Dependence of Phytoplankton Production in Brown-Water Lakes With Special Reference to Lake Paijanne,
W83-00524 5C

The Annual Flood Regime as a Regulatory Mechanism for Phytoplankton Production in Kainji Lake, Nigeria,
W83-00529 2H

PROJECT PLANNING
Development Process for Improving Irrigation Water Management,
W83-00458 3F

National Acid Precipitation Assessment Plan.
W83-00607 5G

PROPELLANTS
Pollution From US Explosives and Propellants Production,
W83-00441 5D

PROTEINS
Chemiluminescence Method for the Determination of Trace Amounts of Proteins in Natural Waters,
W83-00580 5A

PUBLIC HEALTH
Health Effects Associated With Wastewater Treatment and Disposal,
W83-00371 5C

Disinfection.
W83-00466 5F

Microbiology: Detection of Bacterial Pathogens and Their Occurrence,
W83-00658 5A

PUBLIC OPINION
Evaluation of Public Participation in the Yadkin-Pee Dee Level B River Basin Study,
W83-00612 6B

PUBLIC PARTICIPATION
Evaluation of Public Participation in the Yadkin-Pee Dee Level B River Basin Study,
W83-00612 6B

PUBLIC RELATIONS
Brighten the Beds,
W83-00442 5D

PUBLIC RIGHTS
An Economic Evaluation of Citizen Suits,
W83-00619 6E

PULP AND PAPER INDUSTRY
Survival in Lake Water of Klebsiella Pneumoniae Discharged by a Paper Mill,
W83-00387 5B

PULP WASTES
Halocarbons as Tracer Substances in Studies of the Distribution Patterns of Chlorinated Waters in Coastal Areas,
W83-00435 5B

Biodegradation of Cellulose in Bottom Sediments of Lake Baikal,
W83-00600 5B

PUMPING
Vacuum Technology and Its Application in the Water Industry,
W83-00468 5E

Oxygen Injection Into a Rising Main: Its Effect on Pumping,
W83-00474 5D

PYROLYSIS
Pilot Plant Study on Sewage Sludge Pyrolysis-I,
W83-00647 5E

QUATERNARY AMMONIUM COMPOUNDS
Fate and Distribution of a Quaternary Ammonium Surfactant, Octadecyltrimethylammonium Chloride (OTAC), in Wastewater Treatment,
W83-00433 5D

QUEBEC
Fate of Fenitrothion in Aquatic Microcosms and the Role of Aquatic Plants,
W83-00448 5B

High Frequency Endogenous Periodicities of Chlorophyll Synthesis in Estuarine Phytoplankton,
W83-00570 2L

RADIOACTIVE TRACERS
Ra-228, Ra-226, Rn-222, in South Carolina Ground Water: Measurement Techniques and Isotope Relationships,
W83-00625 5A

RADIOACTIVITY TECHNIQUES
Ra-228, Ra-226, Rn-222, in South Carolina Ground Water: Measurement Techniques and Isotope Relationships,
W83-00625 5A

RADIOECOLOGY
Ra-228, Ra-226, Rn-222, in South Carolina Ground Water: Measurement Techniques and Isotope Relationships,
W83-00625 5A

RADIOISOTOPES
Desorption of Ru106, Cs134, Cs137, Ce144 and Am241 From Intertidal Sediment Contaminated by Nuclear Fuel Reprocessing Effluents,
W83-00437 5B

RADIUM RADIOISOTOPES
Ra-228, Ra-226, Rn-222, in South Carolina Ground Water: Measurement Techniques and Isotope Relationships,
W83-00625 5A

RAINFALL
The IUH of General Hydrologic System Model,
W83-00652 2A

Infiltration Formulas by Curve Number Procedure,
W83-00653 2E

Improvement of Nonlinear Rainfall-Runoff Model,
W83-00654 2A

RAINFALL-RUNOFF RELATIONSHIPS
A Stormwater Management Model for the West Branch Brandywine Creek, Chester County, Pennsylvania,
W83-00562 4A

Improvement of Nonlinear Rainfall-Runoff Model,
W83-00654 2A

RECLAIMED WATER
Legal Liability of Reclaimed Water System Proprietors,
W83-00620 6E

RECREATION
Generation of Fecal and Total Coliform Surges by Stream Flow Manipulation in the Absence of Normal Hydrometeorological Stimuli,
W83-00385 5B

REGIONAL ANALYSIS
Legal Liability of Reclaimed Water System Proprietors,
W83-00620 6E

REGIONAL DEVELOPMENT
Evaluation of Public Participation in the Yadkin-Pee Dee Level B River Basin Study,
W83-00612 6B

REGRESSION ANALYSIS
Improvement of Irrigation Scheduling Techniques for Corn With Variable Corn Maturity Range, Plant Population and Water Supply Availability,
W83-00624 3F

RESEARCH PRIORITIES
Water Engineering Research at Swindon.
W83-00469 5F

National Acid Precipitation Assessment Plan.
W83-00607 5G

RESERVATION DOCTRINE
Paleface, Redskin, and the Great White Chiefs in Washington: Drawing the Battle Lines Over Western Water Rights,
W83-00584 6E

RESERVOIR FISHERIES
Studies of the Limnology, Fish Populations, and Fishery of Turquoise Lake, Colorado - 1979-80,
W83-00640 2H

RESERVOIR LINING
The Construction of the Marchwiel Reservoir Using a High Density Polyethylene Lining,
W83-00504 8G

RESERVOIR LININGS
Installation of Flexible Membrane Lining in Mt. Elbert Forebay Reservoir,
W83-00641 8G

RESERVOIR RELEASES
Generation of Fecal and Total Coliform Surges by Stream Flow Manipulation in the Absence of Normal Hydrometeorological Stimuli,
W83-00385 5B

RESERVOIRS
Grafham Water: A Discussion of Limnological Events During the 5-Year Period 1974-1978,
W83-00534 2H

Phytophilous Assemblages of Organisms in Saratov Reservoir,
W83-00579 2H

Studies of the Limnology, Fish Populations, and Fishery of Turquoise Lake, Colorado - 1979-80,
W83-00640 2H

Vertical Circulation in Density-Stratified Reservoir,
W83-00676 2H

RESIDUAL CHLORINE
Determining Free Available Chlorine by DPD-Colorimetric, DPD-Steadifac (Colorimetric), and Facts Procedures,
W83-00453 5A

RESOURCE ALLOCATION
The Economics of Water Allocation,
W83-00544 6E

The Economic Efficiency of Flood Plain Development,
W83-00545 6F

REVERSE OSMOSIS
Reverse Osmosis in an Unstirred Batch System. II. Analysis on Transport Phenomena Across Membrane,
W83-00583 3A

REVIEWS
Health Effects Associated With Wastewater Treatment and Disposal,
W83-00371 5C

Microbiology of Potable Water and Ground Water,
W83-00655 5F

Power Industry Wastes,
W83-00657 5G

REYNOLDS NUMBER
Velocity-Dependent Reaction Rates in a Slime Reactor,
W83-00359 5D

REYNOLDS RIDGE
Flow Beneath a Stagnant Film on Water: The Reynolds Ridge,
W83-00516 8B

RISKS
Emergency Response: A Case for Risk Determination,
W83-00494 5F

RIVER BASIN DEVELOPMENT
Evaluation of Public Participation in the Yadkin-Pee Dee Level B River Basin Study,
W83-00612 6B

RIVER BEDS
Shape and Dimensions of Stationary Dunes in Rivers,
W83-00451 2J

RIVER DIE-AWAY TEST
Evaluation of the River Die-Away Biodegradation Test,
W83-00492 5B

RIVER FLOW
Probability of Annual Flows of the Greater Zab River,
W83-00457 2E

The Impact of Damming the Don River on the Natural Reproduction of the Diadromous Shad,
W83-00593 6G

Effect of Variability of River Runoff on Seawater Intrusion Into River Mouths,
W83-00673 2L

RIVERS
Biological Surveillance of Rivers,
W83-00472 5A

Metal Resistances of Chlorophyta From Rivers Polluted by Heavy Metals,
W83-00538 5C

Low Flow Water Chemistry in Forested and Pasture Catchments, Mawheraiti River, Westland,
W83-00568 5B

Dissolved-Oxygen and Algal Conditions in Selected Locations of the Willamette River Basin, Oregon,
W83-00696 5A

RUNOFF
Accuracy of Snowmelt Runoff Simulation,
W83-00370 2C

Frozen Soil Effects on the Erosion Hazard,
W83-00615 2J

Infiltration Formulas by Curve Number Procedure,
W83-00653 2E

Effect of Variability of River Runoff on Seawater Intrusion Into River Mouths,
W83-00673 2L

SAAR RIVER
Investigation on the Microbiology of the Saar River (Untersuchung Zur Microbiologie Der Saar),
W83-00649 5B

SAFETY
Emergency Response: A Case for Risk Determination,
W83-00494 5F

SALINE LAKES
Physical and Chemical Features of Playa Lakes in Southeastern California, USA,
W83-00372 2H

SALINE WATER
Diluent Composition for Use of API 20E in Characterizing Marine and Estuarine Bacteria,
W83-00388 5A

The Effect of Saline Seeps and Restricted Light Upon the Seasonal Dynamics of Phytoplankton Communities Within a Southwestern (USA) Desert Canyon Stream,
W83-00398 2K

The Density and Composition of Hypersaline Waters of a Mexican Lagoon,
W83-00572 2K

Survey of Joint US - USSR Experience in Effective Use of Saline Irrigated Lands.
W83-00606 3C

SALINE WATER INTRUSION
Effect of Variability of River Runoff on Seawater Intrusion Into River Mouths,
W83-00673 2L

SALINE WATERS
Characteristics and Application of Big Sandy River, Glenwood Springs, and Dotsero Springs Waters in Energy Development,
W83-00639 3C

SALINITY
Dynamics of Mixing in Estuaries,
W83-00420 2L

SALMON
Bioaccumulation of Organochlorines by Yearling Coho Salmon (Oncorhynchus Kisutch Walbaum) Fed Diets Containing Great Lakes' Coho Salmon, and the Pathophysiological Responses of the Recipients,
W83-00418 5C

SALMONIDS
A Conductiometric Technique for Measuring the Water Velocity in Salmonid Spawning Beds,
W83-00644 2F

SALT MARSHES
A Comparative Analysis of the C02 and Water Vapor Responses of Two Spartina Species From Georgia Coastal Marshes,
W83-00421 2I

A Note on the Relocation of Marsh Debris During a Storm Surge,
W83-00422 2L

SALT REJECTION
Reverse Osmosis in an Unstirred Batch System. II. Analysis on Transport Phenomena Across Membrane,
W83-00583 3A

SALT RIVER
Tamarisk and River-Channel Management,
W83-00428 4A

SAMPLING
Water Quality Monitoring: What Directions Should New Programs Take,
W83-00429 5A

Biological Surveillance of Rivers,
W83-00472 5A

Limnological Research Can Improve and Reduce the Cost of Monitoring and Control of Water Quality,
W83-00526 5G

Dispersion Patterns of Phytoplankton in Lakes,
W83-00581 2H

SAN FRANCISCO BAY
Observations From Moored Current Meters in San Francisco Bay, 1978.
W83-00551 7B

SANDSTONE
Extraction and Analysis of Interstitial Water From Sandstone,
W83-00382 5A

SATELLITE TECHNOLOGY
Snow Surface Measurements From Digital Landsat MSS Data,
W83-00362 7C

SCIENTIFIC PERSONNEL
Making Salt Water Drinkable,
W83-00438 3A

SCOTLAND
Instruments for Mountainous Areas,
W83-00361 7B

SCREENS
An Analysis of Mesh Sizes Required for Screening Fishes at Water Intakes,
W83-00450 8I

SEASONAL VARIATION
Microbial Communities in Lake Plussee--An Analysis With Numerical Taxonomy of Isolates,
W83-00399 2H

Establishing the Pattern of Heterotrophic Bacterial Activity in Three Central Amazonian Lakes,
W83-00523 2H

The Forms in Which Manganese Migrates in the Water of the Dnieper and the Desna,
W83-00601 5B

Frozen Soil Effects on the Erosion Hazard,
W83-00615 2J

SEASONAL VARIATIONS
The Seasonal Cycle of Inorganic Carbon Species in Cazenovia Lake, New York, 1977,
W83-00532 2H

SEATTLE
Daily Intake of Lead, Cadmium, Copper, and Zinc From Drinking Water: The Seattle Study of Trace Metal Exposure,
W83-00431 5B

Components of Variation in Lead, Cadmium, Copper, and Zinc Concentration in Home Drinking Water: The Seattle Study of Trace Metal Exposure,
W83-00432 5A

SEAWATER
Desalting Seawater and Brackish Waters: 1981 Cost Update,
W83-00642 3A

SECONDARY WASTEWATER TREATMENT
Sewage Plume in a Sand and Gravel Aquifer, Cape Cod, Massachusetts,
W83-00688 5B

SEDIMENT CORES
Phthalate Ester Concentration Variations in Dated Sediment Cores From the Chesapeake Bay,
W83-00434 5B

SEDIMENT TRANSPORT
Shape and Dimensions of Stationary Dunes in Rivers,
W83-00451 2J

Simulation of Nutrient and Heavy Metal Transport Capacity of Suspended Sediment,
W83-00609 4D

SEDIMENT YIELD
Simulation of Nutrient and Heavy Metal Transport Capacity of Suspended Sediment,
W83-00609 4D

Frozen Soil Effects on the Erosion Hazard,
W83-00615 2J

SEDIMENTATION
Contemporary Sedimentary Environments on Baffin Island, N.W.T., Canada: Glaciomarine Processes in Fiords of Eastern Cumberland Peninsula,
W83-00400 2J

SEDIMENTS
Biology, Metabolism and Functions of Littoral Submersed Weedbeds of Lake Wingra, Wisconsin, USA: A Summary and Review,
W83-00351 2H

Desorption of Ru106, Cs134, Cs137, Ce144 and Am241 From Intertidal Sediment Contaminated by Nuclear Fuel Reprocessing Effluents,
W83-00437 5B

Chlorobenzenes in Sediments, Water, and Selected Fish From Lakes Superior, Huron, Erie, and Ontario,
W83-00444 5B

Effect of Industrial-Residential Zones on Water Quality of Surface Streams,
W83-00460 5B

Convection in Bottom Sediments and its Role in Material Exchange Between Water and Sediments,
W83-00531 5B

Distribution of Enteroviruses in Sediments Contiguous With a Deep Marine Sewage Outfall,
W83-00645 5B

SEEPAGE CONTROL
Installation of Flexible Membrane Lining in Mt. Elbert Forebay Reservoir,
W83-00641 8G

SELENIUM
Determination of Dissolved Selenium in Fresh and Estuarine Waters by Flameless Atomic Absorption,
W83-00404 5A

SELF-PURIFICATION
Ecological and Physiological Profile of Filamentous Green Algae as Factors in the Production of Organic Matter and Control of Water Quality,
W83-00576 2H

Interaction of Bacterial Plankton and Zooplankton in Oligotrophic Water Bodies,
W83-00648 2H

SEPTIC WASTEWATER
Development of a Countywide Model Management Organization for Wastewater,
W83-00622 5D

SETTLING TANKS
Development of a Settling Model for Primary Settling Tanks,
W83-00671 5D

SEWER SYSTEMS
Site Evaluation, Design, Operation, and Installation of Home Sewage Systems in Iowa,
W83-00621 5D

Development of a Countywide Model Management Organization for Wastewater,
W83-00622 5D

Large Subsurface Sewage Disposal Systems,
W83-00626 5B

Cost-Effective Program for Combined Sewer Overflow Abatement,
W83-00659 5G

SHAD
The Impact of Damming the Don River on the Natural Reproduction of the Diadromous Shad,
W83-00593 6G

SHELLFISH FARMING
Metal Levels in the Mussel Mytilus Edulis Collected from Estuaries in South-Eastern Australia,
W83-00411 5A

SHOCK LOADS
Stability and Performance of Anaerobic Fixed Film Reactors During Hydraulic Overloading at 10-35C,
W83-00670 5D

Use of a Kinetic Study to Optimize the Activated Sludge Process,
W83-00677 5D

SHORES
An Index of Littoral Zone Complexity and Its Measurement,
W83-00414 2H

SIMULATION ANALYSIS
Simulation of Nutrient and Heavy Metal Transport Capacity of Suspended Sediment,
W83-00609 4D

An Applied Coupled Simulation-Optimization Model of Water Use Efficiency in Intensive Fish Culture Systems,
W83-00617 8I

SINKS
Remedial Treatment Exploration, Wolf Creek Dam, KY,
W83-00651 8E

SLIME
Velocity-Dependent Reaction Rates in a Slime Reactor,
W83-00359 5D

SLUDGE
Sludge Treatment, Utilization, and Disposal,
W83-00483 5E

SLUDGE BULKING
Control of Algal Filamentous Bulking at the Southerly Wastewater Treatment Plant,
W83-00369 5D

SLUDGE DEWATERING
Pilot Plant Study on Sewage Sludge Pyrolysis-I,
W83-00647 5E

SLUDGE DIGESTION
Uprating Sludge Treatment Processes,
W83-00462 5E

Operating Experience With Thermophilic Anaerobic Digestion,
W83-00490 5D

Benthal Stabilization of Waste Activated Sludge,
W83-00679 5E

SLUDGE DISPOSAL
Vacuum Technology and Its Application in the Water Industry,
W83-00468 5E

Sludge Treatment, Utilization, and Disposal,
W83-00483 5E

SLUDGE DISPOSAL

Composting Sewage Sludge by Means of Forced Aeration,
W83-00614 5E

Interlaboratory Testing of the Leachability of Wastes and Sludges (Ringversuche zur Bestimmung Der Eluierbarkeit Von Abfallen und Schlammen Mit Wasser),
W83-00650 5B

SLUDGE THICKENING
Uprating Sludge Treatment Processes,
W83-00462 5E

SLUDGE UTILIZATION
Sludge Treatment, Utilization, and Disposal,
W83-00483 5E

Sludge Incineration With Energy Recovery,
W83-00608 5E

Composting Sewage Sludge by Means of Forced Aeration,
W83-00614 5E

Physical and Chemical Characteristics of Synthetic Asphalt Produced From Liquefaction of Sewage Sludge,
W83-00636 5E

SMALL WATERSHEDS
Estimation of Small-Scale Hydropower Potential,
W83-00357 6A

SNOW COVER
Snow Surface Measurements From Digital Landsat MSS Data,
W83-00362 7C

SNOWMELT
Accuracy of Snowmelt Runoff Simulation,
W83-00370 2C

Isotope Input Into Runoff Systems From Melting Snow Covers,
W83-00374 2C

Effect of Scale on the Complexity of Snowmelt Systems,
W83-00375 2C

Measuring and Modelling Snowmelt in Dyrdalen, Western Norway, 1979 and 1980,
W83-00376 2C

Meltwater Hydrology and Hydrochemistry in Snow- and Ice-Covered Mountain Catchments,
W83-00377 2C

Glacial-Hydrological Investigations at the Vernagtferner Glacier as a Basis for a Discharge Model,
W83-00379 2A

Application of the Gravity Flow Theory to the Percolation of Melt Water Through Firn,
W83-00513 2C

SNOWPACK
Environmental Isotope Studies of an Alpine Snowpack,
W83-00360 2C

SODIUM CHLORIDE
Hydrologic Effects on Highway-Deicing Chemicals in Massachusetts,
W83-00558 5B

SOIL CONSERVATION
Nonpoint-Source Pollution Control: A Resource Conservation Perspective,
W83-00665 5G

SOIL PROPERTIES
Empirical Relations Between Soil Components and Water Retention at 1/3 and 15 Atmospheres,
W83-00415 2G

SOLID WASTE DISPOSAL
Sludge Incineration With Energy Recovery,
W83-00608 5E

SOLID WASTES
Determination of Selected Organics in Treated Sludges and Associated Leachates From Coal Conversion Facilities,
W83-00383 5A

SOLITARY WAVES
A Fourier Method for Solving Nonlinear Water-Wave Problems: Application to Solitary-Wave Interactions,
W83-00514 8B

SOLVENTS
Contamination of a Glacial Aquifer at Pease Air Force Base, Portsmouth, New Hampshire,
W83-00495 5B

SORPTION
Sorption of Zinc by Lake Michigan Sediments--Implications for Zinc Water Quality Criteria Standards,
W83-00643 5B

SOUTH CAROLINA
Ra-228, Ra-226, Rn-222, in South Carolina Ground Water: Measurement Techniques and Isotope Relationships,
W83-00625 5A

SOUTH-CENTRAL KANSAS
January 1981 Water Levels, and Data Related to Water-Level Changes, Western and South-Central Kansas,
W83-00553 7C

SPARTINA
A Comparative Analysis of the C02 and Water Vapor Responses of Two Spartina Species From Georgia Coastal Marshes,
W83-00421 2I

A Note on the Relocation of Marsh Debris During a Storm Surge,
W83-00422 2L

SPATIAL DISTRIBUTION
Dispersion Patterns of Phytoplankton in Lakes,
W83-00581 2H

SPAWNING
A Conductiometric Technique for Measuring the Water Velocity in Salmonid Spawning Beds,
W83-00644 2F

SPECIATION
Trace Metal Speciation in Three Victorian Lakes,
W83-00412 5A

Cation-Exchange Behaviour of a Range of Adsorbents and Chromatographic Supports With Regard to Their Suitability for Investigating Trace Metal S peciation in Natural Waters,
W83-00517 5A

SPECIES COMPOSITION
The Effect of Land Use on the Diatom Communities in Lakes,
W83-00530 5C

SPECIES DIVERSITY
Phytoplankton of the Yenisey Bay,
W83-00577 2L

SPECIFICATIONS
Specification for Procurement of Water-Level Sensing Instrumentation, Specification Number HIF-I-1,
W83-00684 7B

SPECTROMETRY
Indirect Determination of Sub-ng Per ml-1 Levels of Phosphorus in Waters by Di-Isobutyl Ketone Extraction of Reduced Molybdoantimonylphosphoric Acid and Inductively-Coupled Plasma Emission Spectrometry,
W83-00380 5A

SPECTROPHOTOMETRY
Extraction-Spectrophotometric Determination of Copper (II) with 4-(2-Pyridylazo) Resorcinol and a Long-Chain Quaternary Ammonium Salt,
W83-00354 5A

Solvent Extraction of Molybdophosphate with Cationic Dyes and Spectrophotometric Determination of Micro Amounts of Phosphate in Waters,
W83-00355 5A

SPECTROSCOPY
Indirect Determination of Sub-ng Per ml-1 Levels of Phosphorus in Waters by Di-Isobutyl Ketone Extraction of Reduced Molybdoantimonylphosphoric Acid and Inductively-Coupled Plasma Emission Spectrometry,
W83-00380 5A

Ra-228, Ra-226, Rn-222, in South Carolina Ground Water: Measurement Techniques and Isotope Relationships,
W83-00625 5A

SPRINKLER IRRIGATION
Sprinkler Irrigation Answers City Waste Problem,
W83-00574 3C

Irrigation in America-Today and Tomorrow,
W83-00592 3F

SPRINKLERS
Wasting Water,
W83-00590 3F

ST. LAWRENCE ESTUARY
High Frequency Endogenous Periodicities of Chlorophyll Synthesis in Estuarine Phytoplankton,
W83-00570 2L

STABILIZATION LAGOONS
Benthal Stabilization of Waste Activated Sludge,
W83-00679 5E

STANDARDS
Treatment Costs Savings Through Monthly Variable Effluent Limits,
W83-00660 6F

STANDPIPES
A Conductiometric Technique for Measuring the Water Velocity in Salmonid Spawning Beds,
W83-00644 2F

STORAGE RESERVOIRS
Studies of the Limnology, Fish Populations, and Fishery of Turquoise Lake, Colorado - 1979-80,
W83-00640 2H

STORM DRAINS
Contamination of a Glacial Aquifer at Pease Air Force Base, Portsmouth, New Hampshire,
W83-00495 5B

STORM-OVERFLOW SEWERS
Cost-Effective Program for Combined Sewer Overflow Abatement,
W83-00659 5G

STORM RUNOFF
A Stormwater Management Model for the West Branch Brandywine Creek, Chester County, Pennsylvania,
W83-00562 4A

Evaluation of the Performance of a Combined Sewer Overflow Retention Tank,
W83-00627 5D

STORM SURGES
A Note on the Relocation of Marsh Debris During a Storm Surge,
W83-00422 2L

STORM WATER
Urban Runoff Control Technology,
W83-00416 5D

The Character and Dispersal of Motorway Run-Off Water,
W83-00461 5B

STRATIFICATION
Seasonal and Spatial Distribution of Humus Fractions in a Chain of Polyhumic Lakes in Southern Finland,
W83-00521 2H

STREAMBEDS
A Conductiometric Technique for Measuring the Water Velocity in Salmonid Spawning Beds,
W83-00644 2F

STREAMFLOW
Phosphorus and Nitrogen Loads in Waters Associated with River Murray Near Albury-Wodonga, and Their Effects on Phytoplankton Populations,
W83-00410 5C

Low-Flow Characteristics of Ohio Streams,
W83-00563 7C

Computer Programs for Modeling Flow and Water Quality of Surface Water Systems,
W83-00687 2A

Acoustic Systems for the Measurement of Streamflow,
W83-00692 7B

STREAMFLOW FORECASTING
Effect of Scale on the Complexity of Snowmelt Systems,
W83-00375 2C

A Rapid, Low-Cost Technique for Estimating Peak Flow for Selected Flood Events,
W83-00613 2E

STREAMS
Statistical Summaries of Water-Quality Data for Two Coal Areas of Jackson County, Colorado,
W83-00550 7C

Background Hydrologic Information in Potential Lignite Mining Areas in Mississippi, August 1980,
W83-00557 7C

An Evaluation of Water-Quality Monitoring in the Brandywine Creek Basin, Pennsylavania, 1973-78,
W83-00560 7C

SUBSTRATES
Distribution of Littoral Crustaceans in the Pelagic Zone of Lake Glubokoye,
W83-00595 2H

SULFITE LIQUORS
The Influence of Sulphite Mill Effluents on Heterotrophic Activity as Measured by Glucose Assimilation,
W83-00536 5C

Anaerobic Treatment of an Industrial Wastewater Containing Acetic Acid, Furfural, and Sulphite,
W83-00587 5D

SURFACE FLOW
Flow Beneath a Stagnant Film on Water: The Reynolds Ridge,
W83-00516 8B

SURFACE-GROUNDWATER RELATIONS
Large Subsurface Sewage Disposal Systems,
W83-00626 5B

SURFACE RUNOFF
Hydrologic Effects on Highway-Deicing Chemicals in Massachusetts,
W83-00558 5B

SURFACE WATER
Water Resources Data for Arizona, Water Year 1980.
W83-00546 7C

Water Resources Data for Washington, Water Year 1980--Volume 2. Eastern Washington.
W83-00547 7C

Water Resources Data for Washington, Water Year 1980--Volume 1. Western Washington.
W83-00548 7C

Water Resources Data, New York, Water Year 1981--Volume 1. Eastern New York Excluding Long Island.
W83-00549 7C

Surface-Water and Climatological Data, Salt Lake County, Utah, Water Year 1980,
W83-00559 7C

Water Resources Data for Maryland and Delaware, Water Year 1981.
W83-00700 7C

SURFACE WATERS
Computer Programs for Modeling Flow and Water Quality of Surface Water Systems,
W83-00687 2A

SURFACTANTS
Fate and Distribution of a Quaternary Ammonium Surfactant, Octadecyltrimethylammonium Chloride (OTAC), in Wastewater Treatment,
W83-00433 5D

Organic Matter and the Surface Charge of Suspended Particles in Estuarine Waters,
W83-00573 2K

SURVEYS
Evaluation of Public Participation in the Yadkin-Pee Dee Level B River Basin Study,
W83-00612 6B

Development of a Countywide Model Management Organization for Wastewater,
W83-00622 5D

SUSPENDED SEDIMENTS
Observations on Nitrate, Phosphate and Silicate in Cleveland Bay, Northern Queensland,
W83-00406 5A

SUSPENDED SOLIDS
Organic Matter and the Surface Charge of Suspended Particles in Estuarine Waters,
W83-00573 2K

Performance of Trickling Filter Plants: Reliability, Stability and Variability,
W83-00634 5D

Development of a Settling Model for Primary Settling Tanks,
W83-00671 5D

SWEDEN
Halocarbons as Tracer Substances in Studies of the Distribution Patterns of Chlorinated Waters in Coastal Areas,
W83-00435 5B

Limnological Research Can Improve and Reduce the Cost of Monitoring and Control of Water Quality,
W83-00526 5G

The Limnological Basis for Planning Water Quality Management,
W83-00527 5G

SWIMMING POOLS
Swimming Pool Water Treatment in the UK,
W83-00470 5F

SWITZERLAND
Environmental Isotope Studies of an Alpine Snowpack,
W83-00360 2C

Snow Surface Measurements From Digital Landsat MSS Data,
W83-00362 7C

Abnormal Behaviour of Zeuzier Arch-Dam (Switzerland), IV. Geological Aspects of the Extraordinary Behaviour of Zeuzier Arch Dam,
W83-00365 8A

Abnormal Behavior of Zeuzier Arch-Dam (Switzerland) I. General View,
W83-00508 8A

SYSTEMS ANALYSIS
The IUH of General Hydrologic System Model,
W83-00652 2A

SYSTEMS ENGINEERING
Practical Application of Linear Programming and Network Flows - Proceedings of the Technology Transfer Workshop.
W83-00628 6A

TAMARISK
Tamarisk and River-Channel Management,
W83-00428 4A

Evapotranspiration From Riparian Vegetation: Water Relations and Irrecoverable Losses for Saltcedar,
W83-00663 3B

Evapotranspiration From Riparian Vegetation: Conserving Water by Reducing Saltcedar Transpiration,
W83-00664 3B

TAXONOMY
Microbial Communities in Lake Plussee--An Analysis With Numerical Taxonomy of Isolates,
W83-00399 2H

TEMPERATURE EFFECTS
Survival in Lake Water of Klebsiella Pneumoniae Discharged by a Paper Mill,
W83-00387 5B

Influence of Temperature and River Discharge on Water Quality of the Western Scheldt Estuary,
W83-00669 5C

TENNESSEE
Bacterial Water Quality: Springs and Streams in the Great Smoky Mountains National Park,
W83-00426 5A

TEST WELLS
Hydrologic Data From Test Wells and Low-Flow Investigations in the Middle Reach of the Eagle River Valley, Alaska, 1980-81,
W83-00682 7C

TESTING PROCEDURES
Interlaboratory Testing of the Leachability of Wastes and Sludges (Ringversuche zur Bestimmung Der Eluierbarkeit Von Abfallen und Schlammen Mit Wasser),
W83-00650 5B

TETRACHLOROETHYLENE
Destruction of Pollutants in Water With Ozone in Combination With Ultraviolet Radiation. 1. General Principles and Oxidation of Tetrachloroethylene,
W83-00446 5F

TEXAS-LOUISIANA
Destruction of Pollutants in Water With Ozone in Combination With Ultraviolet Radiation. 2. Natural Trihalomethane Precursors,
W83-00445 5F

THE NETHERLANDS
Comparison Between the Carbon-14 and Oxygen Consumption Method for the Determination of the Activity of Heterotrophic Bacterial Populations,
W83-00569 2H

THERMAL POLLUTION
The Concentration, Reactivity and Fate of Copper, Nickel and Zinc Associated with a Cooling-Water Plume in Estuarine Waters,
W83-00443 5B

The Feeding of Kanev Reservoir Fishes in Connection With the Discharge of Heated Water From the Tripol'ye Power Station,
W83-00598 5C

Seasonal Succession of Phytoplankton in an Ice-Free Pond Warmed by a Thermal Power Plant,
W83-00605 5C

THERMAL SPRINGS
Thermal Springs in the Salmon River Basin, Central Idaho,
W83-00552 1A

THERMOCHEMICAL PROCESSES
Physical and Chemical Characteristics of Synthetic Asphalt Produced From Liquefaction of Sewage Sludge,
W83-00636 5E

THERMOPHILIC DIGESTION
Operating Experience With Thermophilic Anaerobic Digestion,
W83-00490 5D

TIDAL EFFECTS
High Frequency Endogenous Periodicities of Chlorophyll Synthesis in Estuarine Phytoplankton,
W83-00570 2L

TIN
Factors Affecting the Toxic Effect of Tin on Estuarine Microorganisms,
W83-00393 5C

TORONTO
Evaluation of the Performance of a Combined Sewer Overflow Retention Tank,
W83-00627 5D

TOXICITY
Factors Affecting the Toxic Effect of Tin on Estuarine Microorganisms,
W83-00393 5C

Emergency Response: A Case for Risk Determination,
W83-00494 5F

The Structure and Abundance of Rybinsk Reservoir Zooplankton as a Function of the Concentration of Zinc and Chromium Compounds,
W83-00596 5C

Fundamental Principles of the Comparative Toxicological Experiment,
W83-00603 5C

Community Health Associated With Arsenic in Drinking Water in Millard County, Utah,
W83-00630 5C

TRACE METALS
Daily Intake of Lead, Cadmium, Copper, and Zinc From Drinking Water: The Seattle Study of Trace Metal Exposure,
W83-00431 5B

Components of Variation in Lead, Cadmium, Copper, and Zinc Concentration in Home Drinking Water: The Seattle Study of Trace Metal Exposure,
W83-00432 5A

An Automatic Voltammetric Analyzer for the Simultaneous Determination of Toxic Trace Metals in Water,
W83-00510 7B

The Resorption of Zinc From Scales of Sea Trout (Salmo Trutta) During the Upstream Spawning Migration,
W83-00511 5B

Cation-Exchange Behaviour of a Range of Adsorbents and Chromatographic Supports With Regard to Their Suitability for Investigating Trace Metal S peciation in Natural Waters,
W83-00517 5A

Species Associations and Metal Contents of Algae From Rivers Polluted by Heavy Metals,
W83-00537 5C

TRACERS
The Use of Uric Acid as a Method of Tracing Domestic Sewage Discharges in Riverine, Estuarine and Coastal Water Environments,
W83-00646 5A

TRANSPIRATION
A Comparative Analysis of the C02 and Water Vapor Responses of Two Spartina Species From Georgia Coastal Marshes,
W83-00421 2I

TRANSPIRATION CONTROL
Evapotranspiration From Riparian Vegetation: Water Relations and Irrecoverable Losses for Saltcedar,
W83-00663 3B

Evapotranspiration From Riparian Vegetation: Conserving Water by Reducing Saltcedar Transpiration,
W83-00664 3B

TRANSPORT
Mixing and Transport,
W83-00478 5B

TRASH RACKS
Penstock Entrance Research- Auburn Dam Entrance,
W83-00638 8A

TRICHLOROBENZENE
Measurement of Aquatic Biodegradation Rates by Determining Heterotrophic Uptake of Radiolabeled Pollutants,
W83-00392 5B

TRICHLOROETHYLENE
Contamination of a Glacial Aquifer at Pease Air Force Base, Portsmouth, New Hampshire,
W83-00495 5B

TRICKLING FILTERS
Performance of Trickling Filter Plants: Reliability, Stability and Variability,
W83-00634 5D

TRIHALOMETHANES
Destruction of Pollutants in Water With Ozone in Combination With Ultraviolet Radiation. 2. Natural Trihalomethane Precursors,
W83-00445 5F

Influence of Bromide and Ammonia Upon the Formation of Trihalomethanes Under Water-Treatment Conditions,
W83-00447 5F

TROPHIC LEVEL
Establishing the Pattern of Heterotrophic Bacterial Activity in Three Central Amazonian Lakes,
W83-00523 2H

TSUNAMIS
Boundary Integral Solutions of Water Wave Problems,
W83-00463 8B

TURBIDITY
Colour and Turbidity Removal With Reusable Magnetic Particles-III Immobilized Metal Hydroxide Gels,
W83-00506 5F

The Annual Flood Regime as a Regulatory Mechanism for Phytoplankton Production in Kainji Lake, Nigeria,
W83-00529 2H

ULTRAVIOLET RADIATION
Destruction of Pollutants in Water With Ozone in Combination With Ultraviolet Radiation. 2. Natural Trihalomethane Precursors,
W83-00445 5F

Destruction of Pollutants in Water With Ozone in Combination With Ultraviolet Radiation. 1. General Principles and Oxidation of Tetrachloroethylene,
W83-00446 5F

UNCONFIRMED AQUIFERS
Sewage Plume in a Sand and Gravel Aquifer, Cape Cod, Massachusetts,
W83-00688 5B

UNDERGROUND WASTE DISPOSAL
Regional Geohydrology of the Northern Louisian Salt-Dome Basin, Part I, Conceptual Model and Data Needs,
W83-00691 2F

UNDERSEEPAGE
Remedial Treatment Exploration, Wolf Creek Dam, KY,
W83-00651 8E

UNIT HYDROGRAPHS
The IUH of General Hydrologic System Model,
W83-00652 2A

UNITED KINGDOM
Swimming Pool Water Treatment in the UK,
W83-00470 5F

Microbial Metabolism of Acetate, Propionate, and Butyrate in Anoxic Sediment From the Colne Point Saltmarsh, Essex, U.K.,
W83-00519 2L

Organic Matter and the Surface Charge of Suspended Particles in Estuarine Waters,
W83-00573 2K

The Response of a Perch, Perca Fluviatilis L., Population to Eutrophication and Associated Changes in Fish Fauna in a Small Lake,
W83-00678 5C

UPSTATE NEW YORK
Availability of Water From Aquifers in Upstate New York,
W83-00681 7C

URBAN PLANNING
Industry,
W83-00542 6D

URBAN RUNOFF
Urban Runoff Control Technology,
W83-00416 5D

URBAN WATERSHEDS
A Rapid, Low-Cost Technique for Estimating Peak Flow for Selected Flood Events,
W83-00613 2E

URIC ACID
The Use of Uric Acid as a Method of Tracing Domestic Sewage Discharges in Riverine, Estuarine and Coastal Water Environments,
W83-00646 5A

USSR
Effect of Industrial-Residential Zones on Water Quality of Surface Streams,
W83-00460 5B

Electron Microscopic Investigation of Microorganisms in Waters of Different Color,
W83-00575 2H

Phytoplankton of the Yenisey Bay,
W83-00577 2L

Diel Dynamics of Phytoplankton in Lake Kandry-Kul,
W83-00578 2H

Phytophilous Assemblages of Organisms in Saratov Reservoir,
W83-00579 2H

Chemiluminescence Method for the Determination of Trace Amounts of Proteins in Natural Waters,
W83-00580 5A

The Impact of Damming the Don River on the Natural Reproduction of the Diadromous Shad,
W83-00593 6G

Distribution of Littoral Crustaceans in the Pelagic Zone of Lake Glubokoye,
W83-00595 2H

The Structure and Abundance of Rybinsk Reservoir Zooplankton as a Function of the Concentration of Zinc and Chromium Compounds,
W83-00596 5C

Destruction of Organic Matter by Higher Water Plants Under Experimental Conditions,
W83-00597 2H

The Feeding of Kanev Reservoir Fishes in Connection With the Discharge of Heated Water From the Tripol'ye Power Station,
W83-00598 5C

The Main Approaches to the Study of the Cycle of Biological Elements in the Dnieper Reservoirs,
W83-00599 5B

Biodegradation of Cellulose in Bottom Sediments of Lake Baikal,
W83-00600 5B

The Forms in Which Manganese Migrates in the Water of the Dnieper and the Desna,
W83-00601 5B

Ecological Assessment of Water Quality in the Estuarine Region of the Danube,
W83-00602 5B

Interaction of Bacterial Plankton and Zooplankton in Oligotrophic Water Bodies,
W83-00648 2H

Effect of Variability of River Runoff on Seawater Intrusion Into River Mouths,
W83-00673 2L

UTAH
Surface-Water and Climatological Data, Salt Lake County, Utah, Water Year 1980,
W83-00559 7C

UTILITIES
National Drinking Water Advisory Council and Water Utility Council: What Do They Do.,
W83-00503 5G

VAPOR COMPRESSION DISTILLATION
New Evaporation Process: Key to Zero Discharge for Electroplaters.
W83-00417 5D

VARIABILITY
Evaluation of the River Die-Away Biodegradation Test,
W83-00492 5B

VERNAGTFEONER GLACIER
Glacial-Hydrological Investigations at the Vernagtferner Glacier as a Basis for a Discharge Model,
W83-00379 2A

VIRGINIA
Kepone Distribution in Selected Tissues of Blue Crabs, Callinectes Sapidus, Collected From the James River and Lower Chesapeake Bay,
W83-00436 5B

VIRUS CONCENTRATION METHODS
Evaluation of the Tentative Standard Method for Enteric Virus Concentration and Detection,
W83-00629 5A

VIRUSES
Fate of Virus in Wastewater Applied to Slow-Infiltration Land Treatment Systems,
W83-00386 5B

Evaluation of the Tentative Standard Method for Enteric Virus Concentration and Detection,
W83-00629 5A

Distribution of Enteroviruses in Sediments Contiguous With a Deep Marine Sewage Outfall,
W83-00645 5B

WALES
The Construction of the Marchwiel Reservoir Using a High Density Polyethylene Lining,
W83-00504 8G

WASHINGTON
Widespread Distribution of Ability to Oxidize Manganese Among Freshwater Bacteria,
W83-00390 5B

Daily Intake of Lead, Cadmium, Copper, and Zinc From Drinking Water: The Seattle Study of Trace Metal Exposure,
W83-00431 5B

Components of Variation in Lead, Cadmium, Copper, and Zinc Concentration in Home Drinking Water: The Seattle Study of Trace Metal Exposure,
W83-00432 5A

Water Resources Data for Washington, Water Year 1980--Volume 2. Eastern Washington.
W83-00547 7C

Water Resources Data for Washington, Water Year 1980--Volume 1. Western Washington.
W83-00548 7C

WASTE DISPOSAL
Onsite Alternatives for Treatment and Disposal,
W83-00482 5D

Ground-Water Pollution Investigations in the Great Ouse Basin. II-Solid Waste Disposal,
W83-00507 5B

Site Evaluation, Design, Operation, and Installation of Home Sewage Systems in Iowa,
W83-00621 5D

Survey of On-Going and Completed Remedial Action Projects,
W83-00637 5G

WASTE RECOVERY
Sludge Incineration With Energy Recovery,
W83-00608 5E

WASTEWATER ANALYSIS
Extraction-Spectrophotometric Determination of Copper (II) with 4-(2-Pyridylazo) Resorcinol and a Long-Chain Quaternary Ammonium Salt,
W83-00354 5A

Rapid Screening Technique Utilising High-Performance Liquid Chromatography for Assessing Acrylamide Contamination in Effluents,
W83-00381 5A

Development of Analytical Test Procedures for Organic Pollutants in Wastewater - Application to Pesticides,
W83-00632 5A

WASTEWATER DISPOSAL
Health Effects Associated With Wastewater Treatment and Disposal,
W83-00371 5C

The Economics of Municipal Wastewater Reuse,
W83-00465 6B

Waybill System is a Key to Industrial Waste Management and Disposal,
W83-00611 5G

Large Subsurface Sewage Disposal Systems,
W83-00626 5B

WASTEWATER FACILITIES
Brighten the Beds,
W83-00442 5D

Operation and Maintenance of Wastewater Systems Including Instrumentation and Automation,
W83-00481 5D

Site Evaluation, Design, Operation, and Installation of Home Sewage Systems in Iowa,
W83-00621 5D

WASTEWATER IRRIGATION
Fate of Virus in Wastewater Applied to Slow-Infiltration Land Treatment Systems,
W83-00386 5B

Sprinkler Irrigation Answers City Waste Problem,
W83-00574 3C

WASTEWATER LAGOONS
Sprinkler Irrigation Answers City Waste Problem,
W83-00574 3C

WASTEWATER MANAGEMENT
Development of a Countywide Model Management Organization for Wastewater,
W83-00622 5D

Evaluation of the Performance of a Combined Sewer Overflow Retention Tank,
W83-00627 5D

WASTEWATER MANAGMENT
Waybill System is a Key to Industrial Waste Management and Disposal,
W83-00611 5G

WASTEWATER POLLUTION
Intertidal Community Offshore from the Werribee Sewage-Treatment Farm: An Opportunistic Infaunal Assemblage,
W83-00409 5C

WASTEWATER TREATMENT
Rapid Infiltration Treatment of Primary and Secondary Effluents,
W83-00358 5D

Velocity-Dependent Reaction Rates in a Slime Reactor,
W83-00359 5D

Control of Algal Filamentous Bulking at the Southerly Wastewater Treatment Plant,
W83-00369 5D

Health Effects Associated With Wastewater Treatment and Disposal,
W83-00371 5C

The Theory and Design of Aerobic Biological Treatment,
W83-00413 5D

New Evaporation Process: Key to Zero Discharge for Electroplaters.
W83-00417 5D

Lime in Wastewater Treatment,
W83-00427 5D

Fate and Distribution of a Quaternary Ammonium Surfactant, Octadecyltrimethylammonium Chloride (OTAC), in Wastewater Treatment,
W83-00433 5D

Some Options for Treating Liquid Wastes From Nitrogen Fertilizer Factories,
W83-00440 5D

Pollution From US Explosives and Propellants Production,
W83-00441 5D

Removing Metals From Waste Solutions With Low Rank Coals and Related Materials,
W83-00471 5D

Oxygen Injection Into a Rising Main: Its Effect on Pumping,
W83-00474 5D

First Impressions of a Novel Aeration System for Activated Sludge Plants,
W83-00475 5D

A Comparison of the Carrousel and Pasveer Ditch Activated Sludge Plant,
W83-00476 5D

Denitrification,
W83-00480 5D

Operation and Maintenance of Wastewater Systems Including Instrumentation and Automation,
W83-00481 5D

Onsite Alternatives for Treatment and Disposal,
W83-00482 5D

Biological Filters,
W83-00484 5D

Lagoons and Oxidation Ponds,
W83-00485 5D

Physical and Chemical Methods,
W83-00486 5D

Disinfection,
W83-00487 5F

Effect of EDTA on Cadmium in Activated Sludge Systems,
W83-00489 5D

Factors Limiting Emulsified Lipid Treatment Capacity of Activated Sludge,
W83-00499 5D

Evaluation and Comparison of Digester Gas Mixing Systems,
W83-00500 5D

New Sludge System Reduces Landfilling Needs at Weyerhaeuser.
W83-00586 5D

Anaerobic Treatment of an Industrial Wastewater Containing Acetic Acid, Furfural, and Sulphite,
W83-00587 5D

Site Evaluation, Design, Operation, and Installation of Home Sewage Systems in Iowa,
W83-00621 5D

Development of a Countywide Model Management Organization for Wastewater,
W83-00622 5D

Performance of Trickling Filter Plants: Reliability, Stability and Variability,
W83-00634 5D

Pilot Plant Study on Sewage Sludge Pyrolysis-I,
W83-00647 5E

The Effect of Water Hardness on Nitrilotriacetate Removal and Microbial Acclimation in Activated Sludge,
W83-00668 5D

Stability and Performance of Anaerobic Fixed Film Reactors During Hydraulic Overloading at 10-35C,
W83-00670 5D

Development of a Settling Model for Primary Settling Tanks,
W83-00671 5D

Comparative Evaluation of Mathematic Models Used for Calculating Aeration Tanks,
W83-00672 5D

WASTEWATER TREATMENT FACILITIES
Model Protocol for the Comprehensive Evaluation of Publicly Owned Treatment Works Performance and Operation,
W83-00631 5D

WATER ALLOCATION
The Ganges Basin and the Water Dispute,
W83-00455 4A

Energy,
W83-00543 6C

Economic Evaluation of Groundwater Policy Alternatives in the Northern Great Plains,
W83-00623 4B

Colorado Water Rights - An Engineer's Case Studies,
W83-00675 6E

WATER ANALYSIS
Solvent Extraction of Molybdophosphate with Cationic Dyes and Spectrophotometric Determination of Micro Amounts of Phosphate in Waters,
W83-00355 5A

Indirect Determination of Sub-ng Per ml-1 Levels of Phosphorus in Waters by Di-Isobutyl Ketone Extraction of Reduced Molybdoantimonylphosphoric Acid and Inductively-Coupled Plasma Emission Spectrometry,
W83-00380 5A

Use of a Hydride-Generation Technique for the Atomic Absorption Determination of Lead in Drinking Water,
W83-00401 5A

Determination of Arsenic in Synthetic Fuel Process Waters,
W83-00402 5A

Influence of Valence State on the Determination of Antimony, Arsenic, Bismuth, Selenium and Tellurium in Lake Water Using the Hydride AA Technique,
W83-00403 5A

Determination of Dissolved Selenium in Fresh and Estuarine Waters by Flameless Atomic Absorption,
W83-00404 5A

Determination of Arsenic in Potable, Fresh and Estuarine Water by Flameless Atomic Absorption,
W83-00405 5A

Determining Free Available Chlorine by DPD-Colorimetric, DPD-Steadifac (Colorimetric), and Facts Procedures,
W83-00453 5A

An Automatic Voltammetric Analyzer for the Simultaneous Determination of Toxic Trace Metals in Water,
W83-00510 7B

Low Flow Water Chemistry in Forested and Pasture Catchments, Mawheraiti River, Westland,
W83-00568 5B

Chemiluminescence Method for the Determination of Trace Amounts of Proteins in Natural Waters,
W83-00580 5A

Development of a Countywide Model Management Organization for Wastewater,
W83-00622 5D

Evaluation of the Tentative Standard Method for Enteric Virus Concentration and Detection,
W83-00629 5A

Hydrogeochemical Prospecting of Ore-Deposits, Demonstrated on Some Water Analyses From Peru. (Hydrogeochemische Prospektion Von Erzlagerstatten Dargestellt Anhand Einiger Wasseranalysen Aus Peru),
W83-00674 5B

WATER COSTS
Agriculture,
W83-00540 3F

Energy,
W83-00543 6C

WATER DEMAND
Energy,
W83-00543 6C

The Economics of Water Allocation,
W83-00544 6E

WATER DISTRIBUTION
Mains Infestation Control Using Permethrin,
W83-00498 5F

WATER EXCHANGE
The Economics of Water Allocation,
W83-00544 6E

WATER LAW
Protecting Streamflows in California,
W83-00425 6E

Beyond Section 858: A Proposed Ground-Water Liability and Management System for the Eastern United States,
W83-00439 6E

WATER LEVEL
January 1981 Water Levels, and Data Related to Water-Level Changes, Western and South-Central Kansas,
W83-00553 7C

WATER LEVEL FLUCTUATIONS
January 1981 Water Levels, and Data Related to Water-Level Changes, Western and South-Central Kansas,
W83-00553 7C

WATER LEVEL RECORDERS
Specification for Procurement of Water-Level Sensing Instrumentation, Specification Number HIF-I-1,
W83-00684 7B

WATER MANAGEMENT
Empirical Relations Between Soil Components and Water Retention at 1/3 and 15 Atmospheres,
W83-00415 2G

Beyond Section 858: A Proposed Ground-Water Liability and Management System for the Eastern United States,
W83-00439 6E

Development Process for Improving Irrigation Water Management,
W83-00458 3F

Steady-State Ecosystem Modeling for Lake Management,
W83-00610 5G

WATER POLICY
New DEQ Water Policy More Receptive to City Needs,
W83-00423 5F

WATER POLLUTION
An Economic Evaluation of Citizen Suits,
W83-00619 6E

Dissolved-Oxygen and Algal Conditions in Selected Locations of the Willamette River Basin, Oregon,
W83-00696 5A

WATER POLLUTION CONTROL
Adjudicatory Hearings as Part of the NPDES Hearing Process,
W83-00424 6E

Non-Point Sources,
W83-00479 5B

'Plain Meaning' Decision Clarifies Standard for Effluent Limitations,
W83-00567 6E

Survey of On-Going and Completed Remedial Action Projects,
W83-00637 5G

WATER POLLUTION EFFECTS
The Resorption of Zinc From Scales of Sea Trout (Salmo Trutta) During the Upstream Spawning Migration,
W83-00511 5B

Some Effects of Organic Pollution on the Distribution and Seasonal Incidence of Chironomidae in Riffles in the River Cole,
W83-00539 5C

Effects of Chlorinated Sewage Effluents on Fish in the Sheep River, Alberta,
W83-00582 5C

Community Health Associated With Arsenic in Drinking Water in Millard County, Utah,
W83-00630 5C

Investigation on the Microbiology of the Saar River (Untersuchung Zur Microbiologie Der Saar),
W83-00649 5B

Managing Water Quality in Channel Catfish Ponds,
W83-00666 5G

WATER POLLUTION SOURCES
Non-Point Sources,
W83-00479 5B

Organic and Organotin Compounds Leached From PVC and CPVC Pipe,
W83-00633 5F

Monitoring to Detect Groundwater Problems Resulting From Enhanced Oil Recovery,
W83-00635 5B

Survey of On-Going and Completed Remedial Action Projects,
W83-00637 5G

WATER QUALITY
Bacterial Water Quality: Springs and Streams in the Great Smoky Mountains National Park,
W83-00426 5A

An Oxygen Model for Lake Haukivesi,
W83-00525 5C

Water Resources Data for Arizona, Water Year 1980.
W83-00546 7C

Water Resources Data for Washington, Water Year 1980--Volume 2. Eastern Washington.
W83-00547 7C

Water Resources Data for Washington, Water Year 1980--Volume 1. Western Washington.
W83-00548 7C

Water Resources Data, New York, Water Year 1981--Volume 1. Eastern New York Excluding Long Island.
W83-00549 7C

Statistical Summaries of Water-Quality Data for Two Coal Areas of Jackson County, Colorado,
W83-00550 7C

Background Hydrologic Information in Potential Lignite Mining Areas in Mississippi, August 1980,
W83-00557 7C

Hydrologic Effects on Highway-Deicing Chemicals in Massachusetts,
W83-00558 5B

Surface-Water and Climatological Data, Salt Lake County, Utah, Water Year 1980,
W83-00559 7C

An Evaluation of Water-Quality Monitoring in the Brandywine Creek Basin, Pennsylvania, 1973-78,
W83-00560 7C

Hydrology and Chemical Quality of Ground Water in Kiowa County, Colorado,
W83-00561 7C

Influence of Temperature and River Discharge on Water Quality of the Western Scheldt Estuary,
W83-00669 5C

Computer Programs for Modeling Flow and Water Quality of Surface Water Systems,
W83-00687 2A

Ground-Water Quality in East-Central Idaho Valleys,
W83-00694 7C

Water Resources Data for Maryland and Delaware, Water Year 1981.
W83-00700 7C

WATER QUALITY CONTROL
Continuous Monitoring, Automated Analysis, and Sampling Procedures,
W83-00488 5A

Waybill System is a Key to Industrial Waste Management and Disposal,
W83-00611 5G

Evaluation of the Performance of a Combined Sewer Overflow Retention Tank,
W83-00627 5D

Managing Water Quality in Channel Catfish Ponds,
W83-00666 5G

WATER QUALITY STANDARDS
New DEQ Water Policy More Receptive to City Needs,
W83-00423 5F

Water Quality Monitoring: What Directions Should New Programs Take,
W83-00429 5A

'Plain Meaning' Decision Clarifies Standard for Effluent Limitations,
W83-00567 6E

Sorption of Zinc by Lake Michigan Sediments--Implications for Zinc Water Quality Criteria Standards,
W83-00643 5B

Ground-Water Quality in East-Central Idaho Valleys,
W83-00694 7C

WATER RESOURCES DEVELOPMENT
Analysis of Water Supply Costs in the Washington (D.C.) Area,
W83-00467 6B

WATER REUSE
The Economics of Municipal Wastewater Reuse,
W83-00465 6B

Characteristics and Application of Big Sandy River, Glenwood Springs, and Dotsero Springs Waters in Energy Development,
W83-00639 3C

WATER RIGHTS
East is West and West is West: Have the Twain Met.,
W83-00464 6E

Paleface, Redskin, and the Great White Chiefs in Washington: Drawing the Battle Lines Over Western Water Rights,
W83-00584 6E

Colorado Water Rights - An Engineer's Case Studies,
W83-00675 6E

WATER SAMPLING
Continuous Monitoring, Automated Analysis, and Sampling Procedures,
W83-00488 5A

WATER SCARCITY
Municipal and Domestic Use,
W83-00541 6D

Industry,
W83-00542 6D

The Economics of Water Allocation,
W83-00544 6E

WATER SHORTAGE
East is West and West is West: Have the Twain Met.,
W83-00464 6E

WATER STORAGE
Effect of Length of Fallow Period on Water Storage and Drainage,
W83-00618 3F

WATER SUPPLY
EPA and Water Supply--Present and Future,
W83-00493 5G

National Drinking Water Advisory Council and Water Utility Council: What Do They Do.,
W83-00503 5G

Municipal and Domestic Use,
W83-00541 6D

Industry,
W83-00542 6D

Water Use in the Mississippi Gulf Coast Counties, 1980,
W83-00680 6D

WATER SUPPLY

Aquifer Data From Four Wells in the Mendenhall Valley Near Juneau, Alaska,
W83-00686 7C

WATER SUPPLY DEVELOPMENT
Groundwater Supply Exploration in Semi-Arid Regions for Livestock Extension--A Technical and Economic Appraisal,
W83-00459 6B

WATER TABLE PROFILES
Predicting Depths to the Water Table in Deeply Weathered River Catchments in Nigeria,
W83-00497 2F

WATER TREATMENT
Destruction of Pollutants in Water With Ozone in Combination With Ultraviolet Radiation. 2. Natural Trihalomethane Precursors,
W83-00445 5F

Influence of Bromide and Ammonia Upon the Formation of Trihalomethanes Under Water-Treatment Conditions,
W83-00447 5F

Swimming Pool Water Treatment in the UK,
W83-00470 5F

Denitrification,
W83-00480 5D

Disinfection,
W83-00487 5F

Colour and Turbidity Removal With Reusable Magnetic Particles-III Immobilized Metal Hydroxide Gels,
W83-00506 5F

WATER TREATMENT FACILITIES
Design and Construction of the Pennichuck Water Treatment Plant: The Equipment Supplier's View,
W83-00501 5F

Design and Construction of the Pennichuck Water Treatment Plant: The Owner's View,
W83-00502 5F

WATER USE
Agriculture,
W83-00540 3F

Municipal and Domestic Use,
W83-00541 6D

Economic Evaluation of Groundwater Policy Alternatives in the Northern Great Plains,
W83-00623 4B

Water Use in the Mississippi Gulf Coast Counties, 1980,
W83-00680 6D

WATER USE EFFICIENCY
A Comparative Analysis of the C02 and Water Vapor Responses of Two Spartina Species From Georgia Coastal Marshes,
W83-00421 2I

An Applied Coupled Simulation-Optimization Model of Water Use Efficiency in Intensive Fish Culture Systems,
W83-00617 8I

WAVE PROPAGATION
A Fourier Method for Solving Nonlinear Water-Wave Problems: Application to Solitary-Wave Interactions,
W83-00514 8B

WAVE VELOCITY
The Drift Velocity of Water Waves,
W83-00515 8B

WAVES
Boundary Integral Solutions of Water Wave Problems,
W83-00463 8B

WEED CONTROL
The Use of Herbicides for Aquatic Weed Control in Water Supply Catchments,
W83-00496 3B

WELL YIELD
Availability of Water From Aquifers in Upstate New York,
W83-00681 7C

WEST-CENTRAL FLORIDAN AQUIFER
Ground-Water Levels in Selected Well Fields and in West-Central Florida, September 1981,
W83-00685 7C

WEST GERMANY
Isotope Input Into Runoff Systems From Melting Snow Covers,
W83-00374 2C

Microbial Communities in Lake Plussee--An Analysis With Numerical Taxonomy of Isolates,
W83-00399 2H

Investigation on the Microbiology of the Saar River (Untersuchung Zur Microbiologie Der Saar),
W83-00649 5B

WESTERN KANSAS
January 1981 Water Levels, and Data Related to Water-Level Changes, Western and South-Central Kansas,
W83-00553 7C

WETLANDS
Coastal Zone Development: Mitigation, Marsh Creation, and Decision-Making,
W83-00430 6G

WISCONSIN
Biology, Metabolism and Functions of Littoral Submersed Weedbeds of Lake Wingra, Wisconsin, USA: A Summary and Review,
W83-00351 2H

Assessing Biomass and Production of Bacteria in Eutrophic Lake Mendota, Wisconsin,
W83-00384 2H

YADKIN-PEE DEE RIVER BASIN
Evaluation of Public Participation in the Yadkin-Pee Dee Level B River Basin Study,
W83-00612 6B

ZEUZIER DAM
Abnormal Behaviour of Zeuzier Arch-Dam (Switzerland), IV. Geological Aspects of the Extraordinary Behaviour of Zeuzier Arch Dam,
W83-00365 8A

ZIMBABWE
The Influence of River Flow on Pelagic Sardine Catches in Lake Kariba,
W83-00518 2H

ZINC
The Concentration, Reactivity and Fate of Copper, Nickel and Zinc Associated with a Cooling-Water Plume in Estuarine Waters,
W83-00443 5B

The Structure and Abundance of Rybinsk Reservoir Zooplankton as a Function of the Concentration of Zinc and Chromium Compounds,
W83-00596 5C

Sorption of Zinc by Lake Michigan Sediments--Implications for Zinc Water Quality Criteria Standards,
W83-00643 5B

ZOOPLANKTON
Oxygen Consumption and Ammonia and Phosphate Excretion in Pond Zooplankton,
W83-00571 2H

Distribution of Littoral Crustaceans in the Pelagic Zone of Lake Glubokoye,
W83-00595 2H

The Structure and Abundance of Rybinsk Reservoir Zooplankton as a Function of the Concentration of Zinc and Chromium Compounds,
W83-00596 5C

Interaction of Bacterial Plankton and Zooplankton in Oligotrophic Water Bodies,
W83-00648 2H

AUTHOR INDEX

ABOBA, B.
Monitoring to Detect Groundwater Problems Resulting From Enhanced Oil Recovery, W83-00635 5B

ADAMS, M. S.
Biology, Metabolism and Functions of Littoral Submersed Weedbeds of Lake Wingra, Wisconsin, USA: A Summary and Review, W83-00351 2H

AFANAS'EVA, E. L.
Interaction of Bacterial Plankton and Zooplankton in Oligotrophic Water Bodies, W83-00648 2H

ALEKSEYENKO, V. R.
Survival and Growth of Phytophagous Fish as a Function of Oxygen Concentration in Water, W83-00594 5C

ALEKSEYEV, V. A.
Fundamental Principles of the Comparative Toxicological Experiment, W83-00603 5C

ALEKSINSKAYA, L. I.
Effect of Industrial-Residential Zones on Water Quality of Surface Streams, W83-00460 5B

ALI, M. M.
Large Subsurface Sewage Disposal Systems, W83-00626 5B

ALLEN, M. J.
Microbiology of Potable Water and Ground Water, W83-00655 5F

ALLEN, R. V.
Geohydrology of the Valley-Fill Aquifer in the Elmira Area, Chemung County, New York, W83-00695 7C

Geohydrology of the Valley-Fill Aquifer in the Endicott-Johnson City Area, Broome County, New York, W83-00555 7C

Geohydrology of the Valley-Fill Aquifer in the Jamestown Area, Chautauqua County, New York, W83-00564 7C

AMBACH, W.
Application of the Gravity Flow Theory to the Percolation of Melt Water Through Firn, W83-00513 2C

AMBERG, W.
Abnormal Behaviour of Zeuzier Arch-Dam (Switzerland) VI. Static Calculations, W83-00367 8A

AMOROCHO, J.
Improvement of Nonlinear Rainfall-Runoff Model, W83-00654 2A

ANDERSON, H. R.
Geohydrology of the Glaciolacustrine Aquifer in the Fulton area, Oswego County, New York, W83-00699 7C

Geohydrology of the Valley-Fill Aquifer in the Jamestown Area, Chautauqua County, New York, W83-00564 7C

ANDERSON, N. J.
Colour and Turbidity Removal With Reusable Magnetic Particles-III Immobilized Metal Hydroxide Gels, W83-00506 5F

ANTHONY, A. S.
Lime in Wastewater Treatment, W83-00427 5D

AQUINO, R.
Organic and Organotin Compounds Leached From PVC and CPVC Pipe, W83-00633 5F

ARTHUR, J. K.
Background Hydrologic Information in Potential Lignite Mining Areas in Mississippi, August 1980, W83-00557 7C

Background Hydrologic Information in Potential Lignite Mining Areas in Mississippi, August 1981, W83-00693 7C

ASTON, S. R.
Desorption of Ru106, Cs134, Cs137, Ce144 and Am241 From Intertidal Sediment Contaminated by Nuclear Fuel Reprocessing Effluents, W83-00437 5B

AUCLAIR, J. C.
High Frequency Endogenous Periodicities of Chlorophyll Synthesis in Estuarine Phytoplankton, W83-00570 2L

AUER, M. T.
Ecological Studies and Mathematical Modeling of Cladophora in Lake Huron: 3. The Dependence of Growth Rates on Internal Phosphorus Pool Size, W83-00662 2H

BABARIK, A. I.
Ecological Assessment of Water Quality in the Estuarine Region of the Danube, W83-00602 5B

BAKER, D.
Glacial-Hydrological Investigations at the Vernagtferner Glacier as a Basis for a Discharge Model, W83-00379 2A

BALBA, M. T.
Microbial Metabolism of Acetate, Propionate, and Butyrate in Anoxic Sediment From the Colne Point Saltmarsh, Essex, U.K., W83-00519 2L

BALDING, G. O.
Aquifer Data From Four Wells in the Mendenhall Valley Near Juneau, Alaska, W83-00686 7C

BALL, G. L.
Organic and Organotin Compounds Leached From PVC and CPVC Pipe, W83-00633 5F

BANCROFT, K. C. C.
Rapid Screening Technique Utilising High-Performance Liquid Chromatography for Assessing Acrylamide Contamination in Effluents, W83-00381 5A

BARNES, L. M.
First Impressions of a Novel Aeration System for Activated Sludge Plants, W83-00475 5D

BARR, G. L.
Ground-Water Levels in Selected Well Fields and in West-Central Florida, September 1981, W83-00685 7C

BARTHOLOMEW, G. W.
Measurement of Aquatic Biodegradation Rates by Determining Heterotrophic Uptake of Radiolabeled Pollutants, W83-00392 5B

BATTER, T. R.
Physical and Chemical Characteristics of Synthetic Asphalt Produced From Liquefaction of Sewage Sludge, W83-00636 5E

BAUMANN, P. G.
Evaluation and Comparison of Digester Gas Mixing Systems, W83-00500 5D

BAUSUM, H. T.
Fate of Virus in Wastewater Applied to Slow-Infiltration Land Treatment Systems, W83-00386 5B

BECK, M. M.
Community Health Associated With Arsenic in Drinking Water in Millard County, Utah, W83-00630 5C

BECK, R.
Monitoring to Detect Groundwater Problems Resulting From Enhanced Oil Recovery, W83-00635 5B

BEER, C. E.
Development of a Countywide Model Management Organization for Wastewater, W83-00622 5D

Site Evaluation, Design, Operation, and Installation of Home Sewage Systems in Iowa, W83-00621 5D

BELLI, J. L.
Geohydrology of the Preglacial Genesee Valley, Monroe County, New York, W83-00554 7C

Geohydrology of the Valley-Fill Aquifer in the Elmira Area, Chemung County, New York, W83-00695 7C

Geohydrology of the Valley-Fill Aquifer in the Endicott-Johnson City Area, Broome County, New York, W83-00555 7C

Geohydrology of the Valley-Fill Aquifer in the Jamestown Area, Chautauqua County, New York, W83-00564 7C

Geohydrology of the Valley-Fill Aquifer in the Ramapo and Mahwah Rivers Area, Rockland County, New York, W83-00556 7C

BELLINGER, E. G.
The Character and Dispersal of Motorway Run-Off Water, W83-00461 5B

BELLIS, B.
The Construction of the Marchwiel Reservoir Using a High Density Polyethylene Lining, W83-00504 8G

BENJAMIN, M. W.
Evaluating the Potential for Contaminating Drinking Water From the Corrosion of Tin-Antimony Solder, W83-00452 5B

BENNETT, E. R.
Rapid Infiltration Treatment of Primary and Secondary Effluents, W83-00358 5D

BERCHTEN, A. R.
Abnormal Behaviour of Zeuzier Arch-Dam (Switzerland) V. Examination of Condition and Evaluation of Repair Methods, W83-00366 8A

BIEDERMANN, R.
Abnormal Behavior of Zeuzier Arch-Dam (Switzerland) I. General View, W83-00508 8A

Abnormal Behaviour of Zeuzier Arch-Dam (Switzerland) VII. Programs for Refilling and Monitoring, W83-00368 8A

BIRCH, P. B.
Phosphorus Export from Coastal Plain Drainage Into the Peel-Harvey Estuarine System of Western Australia,
W83-00408 5B

BISHOP, T. D.
A Note on the Relocation of Marsh Debris During a Storm Surge,
W83-00422 2L

BLAZKA, P.
Oxygen Consumption and Ammonia and Phosphate Excretion in Pond Zooplankton,
W83-00571 2H

BLINN, D. W.
The Effect of Saline Seeps and Restricted Light Upon the Seasonal Dynamics of Phytoplankton Communities Within a Southwestern (USA) Desert Canyon Stream,
W83-00398 2K

BLUMTHALER, M.
Application of the Gravity Flow Theory to the Percolation of Melt Water Through Firn,
W83-00513 2C

BOETTNER, E. A.
Organic and Organotin Compounds Leached From PVC and CPVC Pipe,
W83-00633 5F

BORISHANSKII, V. M.
Effect of Industrial-Residential Zones on Water Quality of Surface Streams,
W83-00460 5B

BOULTON, B.
Fate of Fenitrothion in Aquatic Microcosms and the Role of Aquatic Plants,
W83-00448 5B

BOYD, C. E.
Managing Water Quality in Channel Catfish Ponds,
W83-00666 5G

BOYLE, W. C.
Onsite Alternatives for Treatment and Disposal,
W83-00482 5D

BOYLEN, C. W.
Ecological Consequences of Long-Term Exposure of Anabaena Variabilis (Cyanophyceae) to Shifts in Environmental Factors,
W83-00391 5C

BRADLEY, E.
Contamination of a Glacial Aquifer at Pease Air Force Base, Portsmouth, New Hampshire,
W83-00495 5B

BRANDL, Z.
Oxygen Consumption and Ammonia and Phosphate Excretion in Pond Zooplankton,
W83-00571 2H

BRAUN, L. N.
Effect of Scale on the Complexity of Snowmelt Systems,
W83-00375 2C

BRAVEN, J.
The Use of Uric Acid as a Method of Tracing Domestic Sewage Discharges in Riverine, Estuarine and Coastal Water Environments,
W83-00646 5A

BRAZELL, R. S.
Determination of Selected Organics in Treated Sludges and Associated Leachates From Coal Conversion Facilities,
W83-00383 5A

BREGAZZI, P. R.
The Response of a Perch, Perca Fluviatilis L., Population to Eutrophication and Associated Changes in Fish Fauna in a Small Lake,
W83-00678 5C

BREZENSKI, F. T.
Inaccuracy of the Preincubation Modified M-FC Method for Estimating Fecal Coliform Densities in Marine Waters,
W83-00491 5A

BROCK, T. D.
Assessing Biomass and Production of Bacteria in Eutrophic Lake Mendota, Wisconsin,
W83-00384 2H

BROCKWAY, C. E.
Optimal Planning of Irrigation Distribution and Application Systems for a Large Irrigated Area,
W83-00616 3F

BROKAW, L.
The Effect of Saline Seeps and Restricted Light Upon the Seasonal Dynamics of Phytoplankton Communities Within a Southwestern (USA) Desert Canyon Stream,
W83-00398 2K

BROOKS, T. D.
Geohydrology of the Valley-Fill Aquifer in the Cortland-Homer-Preble Area, Cortland and Onondaga Counties, New York,
W83-00697 7C

BROWN, A. E.
An Evaluation of Water-Quality Monitoring in the Brandywine Creek Basin, Pennsylavania, 1973-78,
W83-00560 7C

BROWN, D. K.
Determination of Selected Organics in Treated Sludges and Associated Leachates From Coal Conversion Facilities,
W83-00383 5A

BROWN, L.
Rapid Screening Technique Utilising High-Performance Liquid Chromatography for Assessing Acrylamide Contamination in Effluents,
W83-00381 5A

The Use of Uric Acid as a Method of Tracing Domestic Sewage Discharges in Riverine, Estuarine and Coastal Water Environments,
W83-00646 5A

BROWN, T. J.
Amoebae From Antarctic Soil and Water,
W83-00389 5A

BROWNE, F. X.
Non-Point Sources,
W83-00479 5B

BRUCE, A. M.
Uprating Sludge Treatment Processes,
W83-00462 5E

BRUNE, G.
Anaerobic Treatment of an Industrial Wastewater Containing Acetic Acid, Furfural, and Sulphite,
W83-00587 5D

BRUVOLD, W. H.
Municipal and Domestic Use,
W83-00541 6D

BRYAN, K. A.
The Use of Herbicides for Aquatic Weed Control in Water Supply Catchments,
W83-00496 3B

BURLESON, J. L.
Destruction of Pollutants in Water With Ozone in Combination With Ultraviolet Radiation. 1. General Principles and Oxidation of Tetrachloroethylene,
W83-00446 5F

Destruction of Pollutants in Water With Ozone in Combination With Ultraviolet Radiation. 2. Natural Trihalomethane Precursors,
W83-00445 5F

BUSCH, J. R.
Optimal Planning of Irrigation Distribution and Application Systems for a Large Irrigated Area,
W83-00616 3F

BUTLER, E. I.
The Use of Uric Acid as a Method of Tracing Domestic Sewage Discharges in Riverine, Estuarine and Coastal Water Environments,
W83-00646 5A

CABELLI, V. J.
Inaccuracy of the Preincubation Modified M-FC Method for Estimating Fecal Coliform Densities in Marine Waters,
W83-00491 5A

CADWELL, D. H.
Geohydrology of the Valley-Fill Aquifer in the Ramapo and Mahwah Rivers Area, Rockland County, New York,
W83-00556 7C

CAHET, G.
Comparison Between the Carbon-14 and Oxygen Consumption Method for the Determination of the Activity of Heterotrophic Bacterial Populations,
W83-00569 2H

CAHILL, T. E.
East is West and West is West: Have the Twain Met.,
W83-00464 6E

CAIN, D.
Hydrology and Chemical Quality of Ground Water in Kiowa County, Colorado,
W83-00561 7C

CALLAHAN, J. A.
Water Use in the Mississippi Gulf Coast Counties, 1980,
W83-00680 6D

CAMENGA, B.
Wasting Water,
W83-00590 3F

CANALE, R. P.
Ecological Studies and Mathematical Modeling of Cladophora in Lake Huron: 3. The Dependence of Growth Rates on Internal Phosphorus Pool Size,
W83-00662 2H

CANELLI, E.
Determination of Arsenic in Potable, Fresh and Estuarine Water by Flameless Atomic Absorption,
W83-00405 5A

Determination of Dissolved Selenium in Fresh and Estuarine Waters by Flameless Atomic Absorption,
W83-00404 5A

CARLSON, R. R.
Rapid Infiltration Treatment of Primary and Secondary Effluents,
W83-00358 5D

CARNE, R.
Oxygen Injection Into a Rising Main: Its Effect on Pumping,
W83-00474 5D

CARTER, A. P.
Components of Variation in Lead, Cadmium, Copper, and Zinc Concentration in Home Drinking Water: The Seattle Study of Trace Metal Exposure,
W83-00432 5A

Daily Intake of Lead, Cadmium, Copper, and Zinc From Drinking Water: The Seattle Study of Trace Metal Exposure,
W83-00431 5B

CASTALDI, F. J.
Velocity-Dependent Reaction Rates in a Slime Reactor,
W83-00359 5D

CHAN, H. T.
Large Subsurface Sewage Disposal Systems,
W83-00626 5B

CHEN, C.-L.
Infiltration Formulas by Curve Number Procedure,
W83-00653 2E

CHENG, S. S.
Effect of EDTA on Cadmium in Activated Sludge Systems,
W83-00489 5D

CHERNYAVSKAYA, A. P.
Ecological Assessment of Water Quality in the Estuarine Region of the Danube,
W83-00602 5B

CHIARELLA, J. P.
An Evaluation of Water-Quality Monitoring in the Brandywine Creek Basin, Pennsylavania, 1973-78,
W83-00560 7C

CHOW, V. F.
The IUH of General Hydrologic System Model,
W83-00652 2A

CHRISTENSEN, M. N.
Energy,
W83-00543 6C

CHRISTENSEN, R. C.
Surface-Water and Climatological Data, Salt Lake County, Utah, Water Year 1980,
W83-00559 7C

CHRISTIE, D. R.
Coastal Zone Development: Mitigation, Marsh Creation, and Decision-Making,
W83-00430 6G

CHU, T.-Y. J.
Power Industry Wastes,
W83-00657 5G

CICCONE, V. J.
Pollution From US Explosives and Propellants Production,
W83-00441 5D

CLAPP, C. E.
Effect of Liquid Wastewater Sludge Application on Crop Yield and Water Quality,
W83-00656 5E

CLARK, R. M.
Analysis of Water Supply Costs in the Washington (D.C.) Area,
W83-00467 6B

CLOUGH, G. F.
Oxygen Injection Into a Rising Main: Its Effect on Pumping,
W83-00474 5D

COHEN, R.
Decentralizing Water Resource Planning and Management,
W83-00454 6B

COLLINS, C. D.
Ecological Consequences of Long-Term Exposure of Anabaena Variabilis (Cyanophyceae) to Shifts in Environmental Factors,
W83-00391 5C

COLLINS, D. N.
Meltwater Hydrology and Hydrochemistry in Snow- and Ice-Covered Mountain Catchments,
W83-00377 2C

COLLINS, J. C.
Design and Construction of the Pennichuck Water Treatment Plant: The Owner's View,
W83-00502 5F

CONNOR, B. W.
Benthal Stabilization of Waste Activated Sludge,
W83-00679 5E

CONROY, L. S.
Surface-Water and Climatological Data, Salt Lake County, Utah, Water Year 1980,
W83-00559 7C

COOLING, D. A.
Growth and Recession of Aquatic Macrophytes on a Shaded Section of the River Lambourn, England, From 1971 to 1980,
W83-00520 2I

COONEY, J. J.
Factors Affecting the Toxic Effect of Tin on Estuarine Microorganisms,
W83-00393 5C

COOPER, W. J.
Determining Free Available Chlorine by DPD-Colorimetric, DPD-Steadifac (Colorimetric), and Facts Procedures,
W83-00453 5A

COPPOCK, R. H.
Agriculture,
W83-00540 3F

COUCH, R. W.
Effects of 2,4-D on Non-Target Species in Kerr Reservoir,
W83-00378 3B

CRAIK, A. D. D.
The Drift Velocity of Water Waves,
W83-00515 8B

CRAMER, P.
Development of Analytical Test Procedures for Organic Pollutants in Wastewater - Application to Pesticides,
W83-00632 5A

CROWTHER, R. F.
Mains Infestation Control Using Permethrin,
W83-00498 5F

CULLEN, G. V.
Removing Metals From Waste Solutions With Low Rank Coals and Related Materials,
W83-00471 5D

CURSONS, R. T. M.
Amoebae From Antarctic Soil and Water,
W83-00389 5A

DAVENPORT, D. C.
Evapotranspiration From Riparian Vegetation: Conserving Water by Reducing Saltcedar Transpiration,
W83-00664 3B

Evapotranspiration From Riparian Vegetation: Water Relations and Irrecoverable Losses for Saltcedar,
W83-00663 3B

DAVEY, S.
Waybill System is a Key to Industrial Waste Management and Disposal,
W83-00611 5G

DAVIES, L. J.
Some Effects of Organic Pollution on the Distribution and Seasonal Incidence of Chironomidae in Riffles in the River Cole,
W83-00539 5C

DAVIES, R. W.
Effects of Chlorinated Sewage Effluents on Fish in the Sheep River, Alberta,
W83-00582 5C

DAVIES, S. H. R.
Trace Metal Speciation in Three Victorian Lakes,
W83-00412 5A

DE JONG, R.
Empirical Relations Between Soil Components and Water Retention at 1/3 and 15 Atmospheres,
W83-00415 2G

DE PAUW, N.
Influence of Temperature and River Discharge on Water Quality of the Western Scheldt Estuary,
W83-00669 5C

DEACON, J. E.
Primary Productivity and Nutrient Balance in a Lower Colorado River Reservoir,
W83-00394 2H

DEETER, G. B.
Hydrologic Data From Test Wells and Low-Flow Investigations in the Middle Reach of the Eagle River Valley, Alaska, 1980-81,
W83-00682 7C

DEMERS, S.
High Frequency Endogenous Periodicities of Chlorophyll Synthesis in Estuarine Phytoplankton,
W83-00570 2L

DENISOVA, A. I.
The Main Approaches to the Study of the Cycle of Biological Elements in the Dnieper Reservoirs,
W83-00599 5B

DENTON, M. S.
Continuous Monitoring, Automated Analysis, and Sampling Procedures,
W83-00488 5A

DIETZ, F.
Interlaboratory Testing of the Leachability of Wastes and Sludges (Ringversuche zur Bestimmung Der Eluierbarkeit Von Abfallen und Schlammen Mit Wasser),
W83-00650 5B

DONOVAN, J. M.
Physical and Chemical Characteristics of Synthetic Asphalt Produced From Liquefaction of Sewage Sludge,
W83-00636 5E

DORSEY, J. H.
Intertidal Community Offshore from the Werribee Sewage-Treatment Farm: An Opportunistic Infaunal Assemblage,
W83-00409 5C

DOWDY, R. H.
Effect of Liquid Wastewater Sludge Application on Crop Yield and Water Quality,
W83-00656 5E

DOYLE, W. H. JR.
Data Management System for Urban Hydrology Studies Program,
W83-00683 7C

DOZIER, J. C.
Treatment Costs Savings Through Monthly Variable Effluent Limits,
W83-00660 6F

DRINKWINE, A.
Development of Analytical Test Procedures for Organic Pollutants in Wastewater - Application to Pesticides,
W83-00632 5A

DUNCOMB, D. R.
Effect of Liquid Wastewater Sludge Application on Crop Yield and Water Quality,
W83-00656 5E

DUNN, E. L.
A Comparative Analysis of the C02 and Water Vapor Responses of Two Spartina Species From Georgia Coastal Marshes,
W83-00421 2I

EDIGER, R. D.
Determination of Arsenic in Synthetic Fuel Process Waters,
W83-00402 5A

EDMOND, T. D.
Distribution of Enteroviruses in Sediments Contiguous With a Deep Marine Sewage Outfall,
W83-00645 5B

EFFLER, S. W.
The Seasonal Cycle of Inorganic Carbon Species in Cazenovia Lake, New York, 1977,
W83-00532 2H

EGGER, K.
Abnormal Behaviour of Zeuzier Arch-Dam (Switzerland), III. Geodetic Deformation Measurements,
W83-00364 8A

EINARSSON, A.
The Palaeolimnology of Lake Myvatn, Northern Iceland; Plant and Animal Microfossils in the Sediment,
W83-00533 2H

EISENHAUER, R. J.
Characteristics and Application of Big Sandy River, Glenwood Springs, and Dotsero Springs Waters in Energy Development,
W83-00639 3C

EL-YUSSIF, F.
Probability of Annual Flows of the Greater Zab River,
W83-00457 2E

ELLIOTT, L. W.
New DEQ Water Policy More Receptive to City Needs,
W83-00423 5F

ELORANTA, P.
Seasonal Succession of Phytoplankton in an Ice-Free Pond Warmed by a Thermal Power Plant,
W83-00605 5C

ELWELL, F. H.
National Drinking Water Advisory Council and Water Utility Council: What Do They Do.,
W83-00503 5G

EVENS, R.
The Use of Uric Acid as a Method of Tracing Domestic Sewage Discharges in Riverine, Estuarine and Coastal Water Environments,
W83-00646 5A

FARR, J. L.
Groundwater Supply Exploration in Semi-Arid Regions for Livestock Extension--A Technical and Economic Appraisal,
W83-00459 6B

FASSETT, G. W.
Colorado Water Rights - An Engineer's Case Studies,
W83-00675 6E

FEINLEIB, M.
Components of Variation in Lead, Cadmium, Copper, and Zinc Concentration in Home Drinking Water: The Seattle Study of Trace Metal Exposure,
W83-00432 5A

Daily Intake of Lead, Cadmium, Copper, and Zinc From Drinking Water: The Seattle Study of Trace Metal Exposure,
W83-00431 5B

FENTON, J. D.
A Fourier Method for Solving Nonlinear Water-Wave Problems: Application to Solitary-Wave Interactions,
W83-00514 8B

FERGUSON, J. F.
Evaluating the Potential for Contaminating Drinking Water From the Corrosion of Tin-Antimony Solder,
W83-00452 5B

FERNENDEZ, H.
The Density and Composition of Hypersaline Waters of a Mexican Lagoon,
W83-00572 2K

FIALA, L.
Phosphorus Reduction in a Man-Made Lake by Means of a Small Reservoir on the Inflow,
W83-00396 5G

FIELD, S. D.
The Seasonal Cycle of Inorganic Carbon Species in Cazenovia Lake, New York, 1977,
W83-00532 2H

FILINA, T. N.
Effect of Industrial-Residential Zones on Water Quality of Surface Streams,
W83-00460 5B

FINCH, R. H.
Improvement of Nonlinear Rainfall-Runoff Model,
W83-00654 2A

FITZHARDINGE, R. C.
Benthic Communities in an Estuary with Periodic Deoxygenation,
W83-00407 2L

FOGELQVIST, E.
Halocarbons as Tracer Substances in Studies of the Distribution Patterns of Chlorinated Waters in Coastal Areas,
W83-00435 5B

FORSBERG, C.
Limnological Research Can Improve and Reduce the Cost of Monitoring and Control of Water Quality,
W83-00526 5G

FOSTER, P. L.
Metal Resistances of Chlorophyta From Rivers Polluted by Heavy Metals,
W83-00538 5C

Species Associations and Metal Contents of Algae From Rivers Polluted by Heavy Metals,
W83-00537 5C

FOSTER, S. S. D.
Groundwater Supply Exploration in Semi-Arid Regions for Livestock Extension--A Technical and Economic Appraisal,
W83-00459 6B

FRANCIS, R. C.
Dispersion Patterns of Phytoplankton in Lakes,
W83-00581 2H

FRECHETTE, M.
High Frequency Endogenous Periodicities of Chlorophyll Synthesis in Estuarine Phytoplankton,
W83-00570 2L

FREDSOE, J.
Shape and Dimensions of Stationary Dunes in Rivers,
W83-00451 2J

FREEMAN, D. H.
Phthalate Ester Concentration Variations in Dated Sediment Cores From the Chesapeake Bay,
W83-00434 5B

FRENCH, P. N.
Water Resources and Environmental Planning Using Interactive Graphics,
W83-00456 6A

FRISK, T.
An Oxygen Model for Lake Haukivesi,
W83-00525 5C

FROBEL, R. K.
Installation of Flexible Membrane Lining in Mt. Elbert Forebay Reservoir,
W83-00641 8G

FROST, L. R. JR.
Hydrologic Effects on Highway-Deicing Chemicals in Massachusetts,
W83-00558 5B

FURLONG, F. R.
Vacuum Technology and Its Application in the Water Industry,
W83-00468 5E

GABBERT, W. A.
Simulation of Nutrient and Heavy Metal Transport Capacity of Suspended Sediment,
W83-00609 4D

GAMES, L. M.
Fate and Distribution of a Quaternary Ammonium Surfactant, Octadecyltrimethylammonium Chloride (OTAC), in Wastewater Treatment,
W83-00433 5D

GANLEY, R. C.
Cost-Effective Program for Combined Sewer Overflow Abatement,
W83-00659 5G

GARBER, W. F.
Operating Experience With Thermophilic Anaerobic Digestion,
W83-00490 5D

GARDNER, B. D.
Agriculture,
W83-00540 3F

GELSTHORPE, D.
Extraction and Analysis of Interstitial Water From Sandstone,
W83-00382 5A

GEORGE, D. B.
Lagoons and Oxidation Ponds,
W83-00485 5D

GEORGE, R. S.
Hydrologic Data From Test Wells and Low-Flow Investigations in the Middle Reach of the Eagle River Valley, Alaska, 1980-81,
W83-00682 7C

GERBA, C. P.
Distribution of Enteroviruses in Sediments Contiguous With a Deep Marine Sewage Outfall,
W83-00645 5B

GICOT, O.
Abnormal Behaviour of Zeuzier Arch-Dam (Switzerland). II. Abnormal Dam Deformations and First Investigations About Their Origin,
W83-00363 8A

GILBERT, R.
Contemporary Sedimentary Environments on Baffin Island, N.W.T., Canada: Glaciomarine Processes in Fiords of Eastern Cumberland Peninsula,
W83-00400 2J

GILLEAN, J. I.
Analysis of Water Supply Costs in the Washington (D.C.) Area,
W83-00467 6B

GILLESPIE, D.
Survey of On-Going and Completed Remedial Action Projects,
W83-00637 5G

GIRALT, F.
Stability of Chlorine Dioxide in Aqueous Solution,
W83-00667 5D

GIURGEVICH, J. R.
A Comparative Analysis of the C02 and Water Vapor Responses of Two Spartina Species From Georgia Coastal Marshes,
W83-00421 2I

GLAZE, W. H.
Destruction of Pollutants in Water With Ozone in Combination With Ultraviolet Radiation. 1. General Principles and Oxidation of Tetrachloroethylene,
W83-00446 5F

Destruction of Pollutants in Water With Ozone in Combination With Ultraviolet Radiation. 2. Natural Trihalomethane Precursors,
W83-00445 5F

GODFREY, P. J.
The Eutrophication of Cayuga Lake: A Historical Analysis of the Phytoplankton's Response to Phosphate Detergents,
W83-00509 5C

GOODRICH, J. A.
Analysis of Water Supply Costs in the Washington (D.C.) Area,
W83-00467 6B

GOOSSENS, H.
Comparison Between the Carbon-14 and Oxygen Consumption Method for the Determination of the Activity of Heterotrophic Bacterial Populations,
W83-00569 2H

GRAF, W. L.
Tamarisk and River-Channel Management,
W83-00428 4A

GRAHAM, B. N.
Beyond Section 858: A Proposed Ground-Water Liability and Management System for the Eastern United States,
W83-00439 6E

GRANBERG, K.
Nutrient Dependence of Phytoplankton Production in Brown-Water Lakes With Special Reference to Lake Paijanne,
W83-00524 5C

GRAY, A. C. JR.
Model Protocol for the Comprehensive Evaluation of Publicly Owned Treatment Works Performance and Operation,
W83-00631 5D

GRAY, E. W. JR.
Installation of Flexible Membrane Lining in Mt. Elbert Forebay Reservoir,
W83-00641 8G

GREENHALGH, R.
Fate of Fenitrothion in Aquatic Microcosms and the Role of Aquatic Plants,
W83-00448 5B

GREGORY, E.
Widespread Distribution of Ability to Oxidize Manganese Among Freshwater Bacteria,
W83-00390 5B

GRIZZARD, T. J.
Non-Point Sources,
W83-00479 5B

HAAS, C. N.
Disinfection,
W83-00487 5F

HACKNEY, C. T.
A Note on the Relocation of Marsh Debris During a Storm Surge,
W83-00422 2L

HAEFNER, H.
Snow Surface Measurements From Digital Landsat MSS Data,
W83-00362 7C

HAGAN, R. M.
Evapotranspiration From Riparian Vegetation: Conserving Water by Reducing Saltcedar Transpiration,
W83-00664 3B

Evapotranspiration From Riparian Vegetation: Water Relations and Irrecoverable Losses for Saltcedar,
W83-00663 3B

HALLAS, L. E.
Factors Affecting the Toxic Effect of Tin on Estuarine Microorganisms,
W83-00393 5C

HAM, S. F.
Growth and Recession of Aquatic Macrophytes on a Shaded Section of the River Lambourn, England, From 1971 to 1980,
W83-00520 2I

HARJULA, H.
Nutrient Dependence of Phytoplankton Production in Brown-Water Lakes With Special Reference to Lake Paijanne,
W83-00524 5C

HARKER, R. J.
Ground-Water Pollution Investigations in the Great Ouse Basin. II-Solid Waste Disposal,
W83-00507 5B

HARRELL, C. C.
Drip Tested on Florida Ornamentals, Evaluation of Drip Irrigation for Container Production of Woody Landscape Plants,
W83-00591 3F

HARRIMAN, D. A.
Flood Data in West Windsor Township, Mercer County, New Jersey Through 1981 Water Year,
W83-00690 7C

HARRISON, A. D.
Hydrobiological Studies of Eastern Lesser Antillean Islands VII. St. Lucia: Behavioural Drift and Other Movements of Freshwater Marsh Molluscs,
W83-00395 5B

HARRISON, G. W.
Energy,
W83-00543 6C

HARSTVEIT, K.
Measuring and Modelling Snowmelt in Dyrdalen, Western Norway, 1979 and 1980,
W83-00376 2C

HART, B. T.
Trace Metal Speciation in Three Victorian Lakes,
W83-00412 5A

HARTMAN, R. B.
Rapid Infiltration Treatment of Primary and Secondary Effluents,
W83-00358 5D

HARVEY, R. W.
Determination of Selected Organics in Treated Sludges and Associated Leachates From Coal Conversion Facilities,
W83-00383 5A

HAUGH, R.
Performance of Trickling Filter Plants: Reliability, Stability and Variability,
W83-00634 5D

HAUTALUOMA, J. E.
Development Process for Improving Irrigation Water Management,
W83-00458 3F

HAWKES, H. A.
Biological Surveillance of Rivers,
W83-00472 5A

Some Effects of Organic Pollution on the Distribution and Seasonal Incidence of Chironomidae in Riffles in the River Cole,
W83-00539 5C

HEATH, J. H.
Decentralizing Water Resource Planning and Management,
W83-00454 6B

HELLAWELL, J. M.
The Use of Herbicides for Aquatic Weed Control in Water Supply Catchments,
W83-00496 3B

HELWEG, O. J.
Improvement of Nonlinear Rainfall-Runoff Model,
W83-00654 2A

HERRERA, C. E.
Evaluating the Potential for Contaminating Drinking Water From the Corrosion of Tin-Antimony Solder,
W83-00452 5B

HERRMANN, A.
Isotope Input Into Runoff Systems From Melting Snow Covers,
W83-00374 2C

HESSELBERG, R. J.
Accumulation by Fish of Contaminants Released From Dredged Sediments,
W83-00449 5B

HILEY, P. D.
Growth and Recession of Aquatic Macrophytes on a Shaded Section of the River Lambourn, England, From 1971 to 1980,
W83-00520 2I

HILL, G.
Establishing the Pattern of Heterotrophic Bacterial Activity in Three Central Amazonian Lakes,
W83-00523 2H

HILLMAN, T. J.
Phosphorus and Nitrogen Loads in Waters Associated with River Murray Near Albury-Wodonga, and Their Effects on Phytoplankton Populations,
W83-00410 5C

HIRAOKA, M.
Pilot Plant Study on Sewage Sludge Pyrolysis-I,
W83-00647 5E

HOGGER, J. B.
The Encouragement of Freshwater Crayfish Populations by Attention to the Construction and Maintenance of Waterways,
W83-00505 6G

HOLECEK, T. J.
Geohydrology of the Preglacial Genesee Valley, Monroe County, New York,
W83-00554 7C

Geohydrology of the Valley-Fill Aquifer in the Endicott-Johnson City Area, Broome County, New York,
W83-00555 7C

HOLLAND, J. R.
Treatment Costs Savings Through Monthly Variable Effluent Limits,
W83-00660 6F

HOLLIMAN, M. C.
Making Salt Water Drinkable,
W83-00438 3A

HOLLINGSWORTH, Z.
Organic and Organotin Compounds Leached From PVC and CPVC Pipe,
W83-00633 5F

HOOD, M. A.
Diluent Composition for Use of API 20E in Characterizing Marine and Estuarine Bacteria,
W83-00388 5A

HOPWOOD, A. P.
First Impressions of a Novel Aeration System for Activated Sludge Plants,
W83-00475 5D

HOULT, D. W.
Determination of Arsenic in Synthetic Fuel Process Waters,
W83-00402 5A

HOUTHOOFD, J.
Operation and Maintenance of Wastewater Systems Including Instrumentation and Automation,
W83-00481 5D

HOUTHOOFD, J. M.
Model Protocol for the Comprehensive Evaluation of Publicly Owned Treatment Works Performance and Operation,
W83-00631 5D

HOWITT, R. E.
The Economics of Water Allocation,
W83-00544 6E

HRUDEY, S. E.
Factors Limiting Emulsified Lipid Treatment Capacity of Activated Sludge,
W83-00499 5D

HSIEH, L. P.
Effect of EDTA on Cadmium in Activated Sludge Systems,
W83-00489 5D

HUANG, C. P.
Effect of EDTA on Cadmium in Activated Sludge Systems,
W83-00489 5D

HUANG, F. Y.
Destruction of Pollutants in Water With Ozone in Combination With Ultraviolet Radiation. 1. General Principles and Oxidation of Tetrachloroethylene,
W83-00446 5F

HUANG, R. Y.
Destruction of Pollutants in Water With Ozone in Combination With Ultraviolet Radiation. 2. Natural Trihalomethane Precursors,
W83-00445 5F

HUIBREGTSE, G. L.
Evaluation and Comparison of Digester Gas Mixing Systems,
W83-00500 5D

HUNDTOFT, E. B.
Composite Performance Charts for Drip Irrigation Tubing,
W83-00589 3F

HUNTER, K. A.
Organic Matter and the Surface Charge of Suspended Particles in Estuarine Waters,
W83-00573 2K

HURLEY, M.
The Effect of Saline Seeps and Restricted Light Upon the Seasonal Dynamics of Phytoplankton Communities Within a Southwestern (USA) Desert Canyon Stream,
W83-00398 2K

HUTCHINS, M. L.
Steady-State Ecosystem Modeling for Lake Management,
W83-00610 5G

HUTTUNEN, P.
The Effect of Land Use on the Diatom Communities in Lakes,
W83-00530 5C

HYDE, J. E.
Components of Variation in Lead, Cadmium, Copper, and Zinc Concentration in Home Drinking Water: The Seattle Study of Trace Metal Exposure,
W83-00432 5A

HYDES, O. D.
Swimming Pool Water Treatment in the UK,
W83-00470 5F

IL'YASH, L. V.
Phytoplankton of the Yenisey Bay,
W83-00577 2L

IREDALE, D. R.
Effects of Chlorinated Sewage Effluents on Fish in the Sheep River, Alberta,
W83-00582 5C

ISAACS, R.
Community Health Associated With Arsenic in Drinking Water in Millard County, Utah,
W83-00630 5C

JENKINS, A.
Generation of Fecal and Total Coliform Surges by Stream Flow Manipulation in the Absence of Normal Hydrometeorological Stimuli,
W83-00385 5B

JENSEN, M. E.
Irrigation in America-Today and Tomorrow,
W83-00592 3F

JOHNSON, B. T.
Evaluation of the River Die-Away Biodegradation Test,
W83-00492 5B

JOHNSON, D. P.
Low-Flow Characteristics of Ohio Streams,
W83-00563 7C

JONES, A. D.
The Character and Dispersal of Motorway Run-Off Water,
W83-00461 5B

JONES, J. R.
Evaluation of the River Die-Away Biodegradation Test,
W83-00492 5B

JONES, R. I.
Dispersion Patterns of Phytoplankton in Lakes,
W83-00581 2H

JONES, W. J.
The Effect of Water Hardness on Nitrilotriacetate Removal and Microbial Acclimation in Activated Sludge,
W83-00668 5D

JOSEFSSON, B.
Halocarbons as Tracer Substances in Studies of the Distribution Patterns of Chlorinated Waters in Coastal Areas,
W83-00435 5B

KAIRESALO, T.
Carbon, Phosphorus and Nitrogen Budgets of the Littoral Equisetum Belt in an Oligotrophic Lake,
W83-00522 2H

KAKLINS, I.
Monitoring to Detect Groundwater Problems Resulting From Enhanced Oil Recovery,
W83-00635 5B

KALABINA, L. V.
Chemiluminescence Method for the Determination of Trace Amounts of Proteins in Natural Waters,
W83-00580 5A

KALTWASSER, H.
Investigation on the Microbiology of the Saar River (Untersuchung Zur Microbiologie Der Saar),
W83-00649 5B

KANNINEN, J.
The Role of Nitrogen as a Growth Limiting Factor in the Eutrophic Lake Vesijarvi, Southern Finland,
W83-00604 2H

KANTROWITZ, I. H.
Availability of Water From Aquifers in Upstate New York,
W83-00681 7C

KAO, J. F.
Effect of EDTA on Cadmium in Activated Sludge Systems,
W83-00489 5D

KARANIK, J. M.
Cost-Effective Program for Combined Sewer Overflow Abatement,
W83-00659 5G

KARLMAN, S.-G.
The Annual Flood Regime as a Regulatory Mechanism for Phytoplankton Production in Kainji Lake, Nigeria,
W83-00529 2H

KARTASHEVA, N. V.
The Structure and Abundance of Rybinsk Reservoir Zooplankton as a Function of the Concentration of Zinc and Chromium Compounds,
W83-00596 5C

KASAKURA, T.
Pilot Plant Study on Sewage Sludge Pyrolysis-I,
W83-00647 5E

KAUPPI, L.
The Role of Nitrogen as a Growth Limiting Factor in the Eutrophic Lake Vesijarvi, Southern Finland,
W83-00604 2H

KAY, D.
Generation of Fecal and Total Coliform Surges by Stream Flow Manipulation in the Absence of Normal Hydrometeorological Stimuli,
W83-00385 5B

KELLER, M.
Snow Surface Measurements From Digital Landsat MSS Data,
W83-00362 7C

KENNEDY, C. R.
The Response of a Perch, Perca Fluviatilis L., Population to Eutrophication and Associated Changes in Fish Fauna in a Small Lake,
W83-00678 5C

KENNEDY, K. J.
Stability and Performance of Anaerobic Fixed Film Reactors During Hydraulic Overloading at 10-35C,
W83-00670 5D

KENT, C.
An Index of Littoral Zone Complexity and Its Measurement,
W83-00414 2H

KEYS, E. A.
Amoebae From Antarctic Soil and Water,
W83-00389 5A

KIMBELL, L. J.
Energy,
W83-00543 6C

KIMURA, A.
Indirect Determination of Sub-ng Per ml-1 Levels of Phosphorus in Waters by Di-Isobutyl Ketone Extraction of Reduced Molybdoantimonylphosphoric Acid and Inductively-Coupled Plasma Emission Spectrometry,
W83-00380 5A

KING, J. E.
Fate and Distribution of a Quaternary Ammonium Surfactant, Octadecyltrimethylammonium Chloride (OTAC), in Wastewater Treatment,
W83-00433 5D

KING, P. T.
Ra-228, Ra-226, Rn-222, in South Carolina Ground Water: Measurement Techniques and Isotope Relationships,
W83-00625 5A

KIRCHLECHNER, P.
Application of the Gravity Flow Theory to the Percolation of Melt Water Through Firn,
W83-00513 2C

KIRSCH, G. N.
Cost-Effective Program for Combined Sewer Overflow Abatement,
W83-00659 5G

KLONTZ, G. W.
An Applied Coupled Simulation-Optimization Model of Water Use Efficiency in Intensive Fish Culture Systems,
W83-00617 8I

KNISEL, W. G.
Nonpoint-Source Pollution Control: A Resource Conservation Perspective,
W83-00665 5G

KOELLIKER, J. K.
Effect of Length of Fallow Period on Water Storage and Drainage,
W83-00618 3F

KOL'TSOVA, T. I.
Phytoplankton of the Yenisey Bay,
W83-00577 2L

KOLARIK, L. O.
Colour and Turbidity Removal With Reusable Magnetic Particles-III Immobilized Metal Hydroxide Gels,
W83-00506 5F

KOLESNITSKAYA, G. N.
Biodegradation of Cellulose in Bottom Sediments of Lake Baikal,
W83-00600 5B

KOROVCHINSKIY, N. M.
Distribution of Littoral Crustaceans in the Pelagic Zone of Lake Glubokoye,
W83-00595 2H

KOSKIMIES, I.
Carbon, Phosphorus and Nitrogen Budgets of the Littoral Equisetum Belt in an Oligotrophic Lake,
W83-00522 2H

KOWAL, N. E.
Health Effects Associated With Wastewater Treatment and Disposal,
W83-00371 5C

KRAMER, I.
An Automatic Voltammetric Analyzer for the Simultaneous Determination of Toxic Trace Metals in Water,
W83-00510 7B

KRUMPEN, P.
An Automatic Voltammetric Analyzer for the Simultaneous Determination of Toxic Trace Metals in Water,
W83-00510 7B

KRUP, M.
Denitrification,
W83-00480 5D

KRYLOVA, I. N.
Electron Microscopic Investigation of Microorganisms in Waters of Different Color,
W83-00575 2H

KUBLY, D. M.
Physical and Chemical Features of Playa Lakes in Southeastern California, USA,
W83-00372 2H

KUDRYAVTSEV, V. M.
Destruction of Organic Matter by Higher Water Plants Under Experimental Conditions,
W83-00597 2H

KUGELMAN, I. J.
Operation and Maintenance of Wastewater Systems Including Instrumentation and Automation,
W83-00481 5D

KUHN, G.
Statistical Summaries of Water-Quality Data for Two Coal Areas of Jackson County, Colorado,
W83-00550 7C

KULANDAISWAMY, V. C.
The IUH of General Hydrologic System Model,
W83-00652 2A

KUPARINEN, J.
The Influence of Sulphite Mill Effluents on Heterotrophic Activity as Measured by Glucose Assimilation,
W83-00536 5C

LAENEN, A.
Acoustic Systems for the Measurement of Streamflow,
W83-00692 7B

LAFLEUR, R. G.
Geohydrology of the Valley-Fill Aquifer in the Sprout and Fishkill Creeks Area, Dutchess County, New York,
W83-00698 7C

LAMM, F. R.
Effect of Length of Fallow Period on Water Storage and Drainage,
W83-00618 3F

LANG, H.
Is Evaporation an Important Component in High Alpine Hydrology.
W83-00373 2D

LAPPALAINEN, K. M.
Convection in Bottom Sediments and its Role in Material Exchange Between Water and Sediments,
W83-00531 5B

LARSON, G. L.
Bacterial Water Quality: Springs and Streams in the Great Smoky Mountains National Park,
W83-00426 5A

LARSON, R. J.
Fate and Distribution of a Quaternary Ammonium Surfactant, Octadecyltrimethylammonium Chloride (OTAC), in Wastewater Treatment,
W83-00433 5D

LARSON, W. E.
Effect of Liquid Wastewater Sludge Application on Crop Yield and Water Quality,
W83-00656 5E

LEATHERLAND, J. F.
Bioaccumulation of Organochlorines by Yearling Coho Salmon (Oncorhynchus Kisutch Walbaum) Fed Diets Containing Great Lakes' Coho Salmon, and the Pathophysiological Responses of the Recipients,
W83-00418 5C

LEBEDEVA, L. I.
The Structure and Abundance of Rybinsk Reservoir Zooplankton as a Function of the Concentration of Zinc and Chromium Compounds,
W83-00596 5C

LEBLANC, D. R.
Sewage Plume in a Sand and Gravel Aquifer, Cape Cod, Massachusetts,
W83-00688 5B

LEE, G. F.
Sorption of Zinc by Lake Michigan Sediments--Implications for Zinc Water Quality Criteria Standards,
W83-00643 5B

LEGENDRE, L.
High Frequency Endogenous Periodicities of Chlorophyll Synthesis in Estuarine Phytoplankton,
W83-00570 2L

LEHRER, M.
Isotope Input Into Runoff Systems From Melting Snow Covers,
W83-00374 2C

LEHTOVAARA, A.
Carbon, Phosphorus and Nitrogen Budgets of the Littoral Equisetum Belt in an Oligotrophic Lake,
W83-00522 2H

LEMASSON, L.
Excretion of Dissolved Organic Phosphorus in Tropical Brackish Waters,
W83-00419 2L

LENNON, G. P.
Boundary Integral Solutions of Water Wave Problems,
W83-00463 8B

LEONARD, R. A.
Nonpoint-Source Pollution Control: A Resource Conservation Perspective,
W83-00665 5G

LEWIS, R. E.
Thermal Springs in the Salmon River Basin, Central Idaho,
W83-00552 1A

LICHTENEGGER, J.
Snow Surface Measurements From Digital Landsat MSS Data,
W83-00362 7C

LIDZ, L.
Data on Selected Deep Wells in South Florida,
W83-00689 7C

LIGGETT, J. A.
Boundary Integral Solutions of Water Wave Problems,
W83-00463 8B

LILLY, A. B.
Protecting Streamflows in California,
W83-00425 6E

LIN, C.-C.
Reverse Osmosis in an Unstirred Batch System. II. Analysis on Transport Phenomena Across Membrane,
W83-00583 3A

LIN, S.
Destruction of Pollutants in Water With Ozone in Combination With Ultraviolet Radiation. 2. Natural Trihalomethane Precursors,
W83-00445 5F

LINDEN, D. R.
Effect of Liquid Wastewater Sludge Application on Crop Yield and Water Quality,
W83-00656 5E

LINNIK, P. N.
The Forms in Which Manganese Migrates in the Water of the Dnieper and the Desna,
W83-00601 5B

LINSTEDT, K. D.
Rapid Infiltration Treatment of Primary and Secondary Effluents,
W83-00358 5D

LISS, P. S.
Organic Matter and the Surface Charge of Suspended Particles in Estuarine Waters,
W83-00573 2K

LIU, P. L.-F.
Boundary Integral Solutions of Water Wave Problems,
W83-00463 8B

LOCKWOOD, J. G.
A Computer Simulation of the Effects of Differing Crop Types on the Water Balance of Small Catchments Over Long Time Periods,
W83-00585 2D

LOCKYEAR, C. F.
Uprating Sludge Treatment Processes,
W83-00462 5E

LOEBEL, K.
Empirical Relations Between Soil Components and Water Retention at 1/3 and 15 Atmospheres,
W83-00415 2G

LOFTIS, J. C.
Water Quality Monitoring: What Directions Should New Programs Take,
W83-00429 5A

LOMAKINA, L. V.
Phytophilous Assemblages of Organisms in Saratov Reservoir,
W83-00579 2H

LOMBARDI, G.
Abnormal Behaviour of Zeuzier Arch-Dam (Switzerland) VI. Static Calculations,
W83-00367 8A

LOOMIS, R. S.
Agriculture,
W83-00540 3F

LORENS, J. A.
Computer Programs for Modeling Flow and Water Quality of Surface Water Systems,
W83-00687 2A

Data Management System for Urban Hydrology Studies Program,
W83-00683 7C

LOTTMAN, R. P.
Physical and Chemical Characteristics of Synthetic Asphalt Produced From Liquefaction of Sewage Sludge,
W83-00636 5E

LOUCKS, D. P.
Water Resources and Environmental Planning Using Interactive Graphics,
W83-00456 6A

LOWDERMILK, M. K.
Development Process for Improving Irrigation Water Management,
W83-00458 3F

LOWE, J. S.
Beyond Section 858: A Proposed Ground-Water Liability and Management System for the Eastern United States,
W83-00439 6E

LOWERY, R. S.
The Encouragement of Freshwater Crayfish Populations by Attention to the Construction and Maintenance of Waterways,
W83-00505 6G

LUNDQVIST, I.
The Limnological Basis for Planning Water Quality Management,
W83-00527 5G

LUONG, T. V.
Influence of Bromide and Ammonia Upon the Formation of Trihalomethanes Under Water-Treatment Conditions,
W83-00447 5F

LYE, A. K.
Metal Levels in the Mussel Mytilus Edulis Collected from Estuaries in South-Eastern Australia,
W83-00411 5A

LYNCH, D. R.
Dynamics of Mixing in Estuaries,
W83-00420 2L

LYNN, C. D.
Agriculture,
W83-00540 3F

MAC, M. J.
Accumulation by Fish of Contaminants Released From Dredged Sediments,
W83-00449 5B

MACAULAY, H. H.
An Economic Evaluation of Citizen Suits,
W83-00619 6E

MACDONELL, M. T.
Diluent Composition for Use of API 20E in Characterizing Marine and Estuarine Bacteria,
W83-00388 5A

MACKEY, D. J.
Cation-Exchange Behaviour of a Range of Adsorbents and Chromatographic Supports With Regard to Their Suitability for Investigating Trace Metal S peciation in Natural Waters,
W83-00517 5A

MAHON, K. I.
Geohydrology of the Preglacial Genesee Valley, Monroe County, New York,
W83-00554 7C

MAKSIMOV, V. N.
Biodegradation of Cellulose in Bottom Sediments of Lake Baikal,
W83-00600 5B

MAKSIMOVA, E. A.
Biodegradation of Cellulose in Bottom Sediments of Lake Baikal,
W83-00600 5B

MALINA, J. F. JR.
Velocity-Dependent Reaction Rates in a Slime Reactor,
W83-00359 5D

MANCL, K. M.
Development of a Countywide Model Management Organization for Wastewater,
W83-00622 5D

MANN, D. E.
The Economics of Water Allocation,
W83-00544 6E

MANNING, D. C.
Determination of Arsenic in Synthetic Fuel Process Waters,
W83-00402 5A

MARSALEK, J.
Urban Runoff Control Technology,
W83-00416 5D

MARSHALL, B. E.
The Influence of River Flow on Pelagic Sardine Catches in Lake Kariba,
W83-00518 2H

MARTIN, P. E.
Evapotranspiration From Riparian Vegetation: Conserving Water by Reducing Saltcedar Transpiration,
W83-00664 3B

Evapotranspiration From Riparian Vegetation: Water Relations and Irrecoverable Losses for Saltcedar,
W83-00663 3B

MARTINEC, J.
Accuracy of Snowmelt Runoff Simulation,
W83-00370 2C

Environmental Isotope Studies of an Alpine Snowpack,
W83-00360 2C

MASKARINEC, M. P.
Determination of Selected Organics in Treated Sludges and Associated Leachates From Coal Conversion Facilities,
W83-00383 5A

MATSKO, I. S.
Chemiluminescence Method for the Determination of Trace Amounts of Proteins in Natural Waters,
W83-00580 5A

MCCORMACK, H. F.
Surface-Water and Climatological Data, Salt Lake County, Utah, Water Year 1980,
W83-00559 7C

MCCREARY, J. J.
Disinfection,
W83-00487 5F

MCDONALD, A.
Generation of Fecal and Total Coliform Surges by Stream Flow Manipulation in the Absence of Normal Hydrometeorological Stimuli,
W83-00385 5B

MCKENZIE, S. W.
Dissolved-Oxygen and Algal Conditions in Selected Locations of the Willamette River Basin, Oregon,
W83-00696 5A

MCKILLOP, W. B.
Hydrobiological Studies of Eastern Lesser Antillean Islands VII. St. Lucia: Behavioural Drift and Other Movements of Freshwater Marsh Molluscs,
W83-00395 5B

MCLEISH, P. R.
Growth and Recession of Aquatic Macrophytes on a Shaded Section of the River Lambourn, England, From 1971 to 1980,
W83-00520 2I

MEDINE, A. J.
Eutrophication,
W83-00477 5C

MEDIR, M.
Stability of Chlorine Dioxide in Aqueous Solution,
W83-00667 5D

MELCHER, M.
Influence of Valence State on the Determination of Antimony, Arsenic, Bismuth, Selenium and Tellurium in Lake Water Using the Hydride AA Technique,
W83-00403 5A

MELEAR, E. L.
Physical and Chemical Methods,
W83-00486 5D

MERILAINEN, J.
The Effect of Land Use on the Diatom Communities in Lakes,
W83-00530 5C

MESSINEVA, M. A.
Interaction of Bacterial Plankton and Zooplankton in Oligotrophic Water Bodies,
W83-00648 2H

METZKER, K. D.
Low-Flow Characteristics of Ohio Streams,
W83-00563 7C

MEYER, F. W.
Data on Selected Deep Wells in South Florida,
W83-00689 7C

MEYER, Z.
Vertical Circulation in Density-Stratified Reservoir,
W83-00676 2H

MICHEL, J.
Ra-228, Ra-226, Rn-222, in South Carolina Ground Water: Measurement Techniques and Isotope Relationships,
W83-00625 5A

MILLER, D.
Monitoring to Detect Groundwater Problems Resulting From Enhanced Oil Recovery,
W83-00635 5B

MILLER, H.
Development of Analytical Test Procedures for Organic Pollutants in Wastewater - Application to Pesticides,
W83-00632 5A

MILLER, R. K.
Physical and Chemical Characteristics of Synthetic Asphalt Produced From Liquefaction of Sewage Sludge,
W83-00636 5E

MILLER, T. S.
Geohydrology of the Glaciolacustrine Aquifer in the Fulton area, Oswego County, New York,
W83-00699 7C

Geohydrology of the Valley-Fill Aquifer in the Cortland-Homer-Preble Area, Cortland and Onondaga Counties, New York,
W83-00697 7C

Geohydrology of the Valley-Fill Aquifer in the Elmira Area, Chemung County, New York,
W83-00695 7C

MILLER, W. L.
The Economic Efficiency of Flood Plain Development,
W83-00545 6F

MILLERO, F. J.
The Density and Composition of Hypersaline Waters of a Mexican Lagoon,
W83-00572 2K

MILLNER, G. C.
Lake Erie Cladophora in Perspective,
W83-00661 2H

MITTLEBACH, F. G.
Municipal and Domestic Use,
W83-00541 6D

MIYAZAKI, A.
Indirect Determination of Sub-ng Per ml-1 Levels of Phosphorus in Waters by Di-Isobutyl Ketone Extraction of Reduced Molybdoantimonylphosphoric Acid and Inductively-Coupled Plasma Emission Spectrometry,
W83-00380 5A

MOALEDJ, K.
Microbial Communities in Lake Plussee--An Analysis With Numerical Taxonomy of Isolates,
W83-00399 2H

MOGIL'CHENKO, V. I.
The Impact of Damming the Don River on the Natural Reproduction of the Diadromous Shad,
W83-00593 6G

MOLNAU, M.
Frozen Soil Effects on the Erosion Hazard,
W83-00615 2J

MOODY, R. P.
Fate of Fenitrothion in Aquatic Microcosms and the Role of Aquatic Plants,
W83-00448 5B

MOORE, R. B.
Geohydrology of the Valley-Fill Aquifer in the Ramapo and Mahwah Rivers Area, Rockland County, New York,
W83-00556 7C

Geohydrology of the Valley-Fill Aquifer in the Sprout and Fishkill Creeks Area, Dutchess County, New York,
W83-00698 7C

MOORE, W. S.
Ra-228, Ra-226, Rn-222, in South Carolina Ground Water: Measurement Techniques and Isotope Relationships,
W83-00625 5A

MORRISON, W. R.
Installation of Flexible Membrane Lining in Mt. Elbert Forebay Reservoir,
W83-00641 8G

MOSER, H.
Glacial-Hydrological Investigations at the Vernagtferner Glacier as a Basis for a Discharge Model,
W83-00379 2A

MOSLEY, M. P.
Low Flow Water Chemistry in Forested and Pasture Catchments, Mawheraiti River, Westland,
W83-00568 5B

MOTOMIZU, S.
Solvent Extraction of Molybdophosphate with Cationic Dyes and Spectrophotometric Determination of Micro Amounts of Phosphate in Waters,
W83-00355 5A

MULHOLLAND, J. H.
Sludge Incineration With Energy Recovery,
W83-00608 5E

MULREADY, C. R.
A Comparison of the Carrousel and Pasveer Ditch Activated Sludge Plant,
W83-00476 5D

MURPHY, J. J.
An Evaluation of Water-Quality Monitoring in the Brandywine Creek Basin, Pennsylavania, 1973-78,
W83-00560 7C

MUSTARD, M. H.
Hydrology and Chemical Quality of Ground Water in Kiowa County, Colorado,
W83-00561 7C

NABIVANETS, B. I.
Chemiluminescence Method for the Determination of Trace Amounts of Proteins in Natural Waters,
W83-00580 5A

NAKHSHINA, YE. P.
The Main Approaches to the Study of the Cycle of Biological Elements in the Dnieper Reservoirs,
W83-00599 5B

NEDWELL, D. B.
Microbial Metabolism of Acetate, Propionate, and Butyrate in Anoxic Sediment From the Colne Point Saltmarsh, Essex, U.K.,
W83-00519 2L

NEELY, N.
Survey of On-Going and Completed Remedial Action Projects,
W83-00637 5G

NELSON, E. N.
Effects of 2,4-D on Non-Target Species in Kerr Reservoir,
W83-00378 3B

NESLER, T. P.
Studies of the Limnology, Fish Populations, and Fishery of Turquoise Lake, Colorado - 1979-80,
W83-00640 2H

NEWCOMBE, S.
Oxygen Injection Into a Rising Main: Its Effect on Pumping,
W83-00474 5D

NICHOLSON, S. A.
Changes in Submersed Macrophytes in Chautauqua Lake, 1937-1975,
W83-00535 2H

NICOL, K. D.
Chlorobenzenes in Sediments, Water, and Selected Fish From Lakes Superior, Huron, Erie, and Ontario,
W83-00444 5B

NIEMELA, S. I.
Survival in Lake Water of Klebsiella Pneumoniae Discharged by a Paper Mill,
W83-00387 5B

NIENKE, G. E.
Sorption of Zinc by Lake Michigan Sediments--Implications for Zinc Water Quality Criteria Standards,
W83-00643 5B

NIKU, S.
Performance of Trickling Filter Plants: Reliability, Stability and Variability,
W83-00634 5D

NONOVA, D.
Extraction-Spectrophotometric Determination of Copper (II) with 4-(2-Pyridylazo) Resorcinol and a Long-Chain Quaternary Ammonium Salt,
W83-00354 5A

NUNNALLY, N. R.
A Rapid, Low-Cost Technique for Estimating Peak Flow for Selected Flood Events,
W83-00613 2E

O'DONNELL, G.
Observations on Nitrate, Phosphate and Silicate in Cleveland Bay, Northern Queensland,
W83-00406 5A

O'GRADY, K. T.
The Resorption of Zinc From Scales of Sea Trout (Salmo Trutta) During the Upstream Spawning Migration,
W83-00511 5B

OERTER, H.
Glacial-Hydrological Investigations at the Vernagtferner Glacier as a Basis for a Discharge Model,
W83-00379 2A

OFFICER, C. B.
Dynamics of Mixing in Estuaries,
W83-00420 2L

OLEM, H.
Power Industry Wastes,
W83-00657 5G

OLIVER, A. J.
Cost-Effective Program for Combined Sewer Overflow Abatement,
W83-00659 5G

OLIVER, B. G.
Chlorobenzenes in Sediments, Water, and Selected Fish From Lakes Superior, Huron, Erie, and Ontario,
W83-00444 5B

OLSONBAKER, J.
Sprinkler Irrigation Answers City Waste Problem,
W83-00574 3C

OMORINBOLA, E. O.
Predicting Depths to the Water Table in Deeply Weathered River Catchments in Nigeria,
W83-00497 2F

OREM, B. K.
Paleface, Redskin, and the Great White Chiefs in Washington: Drawing the Battle Lines Over Western Water Rights,
W83-00584 6E

ORHEIM, R. M.
Components of Variation in Lead, Cadmium, Copper, and Zinc Concentration in Home

Drinking Water: The Seattle Study of Trace Metal Exposure,
W83-00432 5A

Daily Intake of Lead, Cadmium, Copper, and Zinc From Drinking Water: The Seattle Study of Trace Metal Exposure,
W83-00431 5B

ORR, J. B.
Non-Point Sources,
W83-00479 5B

OSBORNE, L. L.
Effects of Chlorinated Sewage Effluents on Fish in the Sheep River, Alberta,
W83-00582 5C

OSWALD, E. B.
Nonpoint-Source Pollution Control: A Resource Conservation Perspective,
W83-00665 5G

OTIS, R. J.
Onsite Alternatives for Treatment and Disposal,
W83-00482 5D

OTT, R. R.
Cost-Effective Program for Combined Sewer Overflow Abatement,
W83-00659 5G

OVERBECK, H. J.
Microbial Communities in Lake Plussee--An Analysis With Numerical Taxonomy of Isolates,
W83-00399 2H

PABST, M. E.
January 1981 Water Levels, and Data Related to Water-Level Changes, Western and South-Central Kansas,
W83-00553 7C

PACE, D. W.
A Solution to Screenings Problems by Dewatering and Incineration,
W83-00473 5D

PAGES, J.
Excretion of Dissolved Organic Phosphorus in Tropical Brackish Waters,
W83-00419 2L

PAHREN, H. R.
Health Effects Associated With Wastewater Treatment and Disposal,
W83-00371 5C

PARK, W. M.
The Economic Efficiency of Flood Plain Development,
W83-00545 6F

PARLIMAN, D. J.
Ground-Water Quality in East-Central Idaho Valleys,
W83-00694 7C

PAUL, D. B.
Installation of Flexible Membrane Lining in Mt. Elbert Forebay Reservoir,
W83-00641 8G

PAUL, P. E.
Model Protocol for the Comprehensive Evaluation of Publicly Owned Treatment Works Performance and Operation,
W83-00631 5D

PAYNE, A. G.
The Effect of Water Hardness on Nitrilotriacetate Removal and Microbial Acclimation in Activated Sludge,
W83-00668 5D

PAYNE, D. C.
A Comparison of the Carrousel and Pasveer Ditch Activated Sludge Plant,
W83-00476 5D

PEDERSEN, D.
Inaccuracy of the Preincubation Modified M-FC Method for Estimating Fecal Coliform Densities in Marine Waters,
W83-00491 5A

PEDROS-ALIO, C.
Assessing Biomass and Production of Bacteria in Eutrophic Lake Mendota, Wisconsin,
W83-00384 2H

PENNANEN, V.
Seasonal and Spatial Distribution of Humus Fractions in a Chain of Polyhumic Lakes in Southern Finland,
W83-00521 2H

PERRY, R.
Influence of Bromide and Ammonia Upon the Formation of Trihalomethanes Under Water-Treatment Conditions,
W83-00447 5F

PETERS, C. J.
Influence of Bromide and Ammonia Upon the Formation of Trihalomethanes Under Water-Treatment Conditions,
W83-00447 5F

PETERSON, J. C.
Phthalate Ester Concentration Variations in Dated Sediment Cores From the Chesapeake Bay,
W83-00434 5B

PETRUCCI, V. E.
Drip vs. Flood--Viticulture Research: A Comparison of Two Irrigation Systems in California Vineyards,
W83-00588 3F

PEYTON, G. R.
Destruction of Pollutants in Water With Ozone in Combination With Ultraviolet Radiation. 1. General Principles and Oxidation of Tetrachloroethylene,
W83-00446 5F

Destruction of Pollutants in Water With Ozone in Combination With Ultraviolet Radiation. 2. Natural Trihalomethane Precursors,
W83-00445 5F

PFAENDER, F. K.
Measurement of Aquatic Biodegradation Rates by Determining Heterotrophic Uptake of Radiolabeled Pollutants,
W83-00392 5B

PIRTTIALA, K.
The Effect of Land Use on the Diatom Communities in Lakes,
W83-00530 5C

PITT, W. W. JR.
Continuous Monitoring, Automated Analysis, and Sampling Procedures,
W83-00488 5A

POLLOCK, S. J.
Hydrologic Effects on Highway-Deicing Chemicals in Massachusetts,
W83-00558 5B

POPCHENKO, I. I.
Phytophilous Assemblages of Organisms in Saratov Reservoir,
W83-00579 2H

POPCHENKO, V. I.
Phytophilous Assemblages of Organisms in Saratov Reservoir,
W83-00579 2H

POPPE, D. A.
Estimation of Small-Scale Hydropower Potential,
W83-00357 6A

PORCELLA, D. B.
Eutrophication,
W83-00477 5C

PRAKASAM, T. B. S.
Denitrification,
W83-00480 5D

PRENTKI, R. T.
Biology, Metabolism and Functions of Littoral Submersed Weedbeds of Lake Wingra, Wisconsin, USA: A Summary and Review,
W83-00351 2H

PRICE, G. J.
A Solution to Screenings Problems by Dewatering and Incineration,
W83-00473 5D

PRISCU, J. C.
Primary Productivity and Nutrient Balance in a Lower Colorado River Reservoir,
W83-00394 2H

PROCHAZKOVA, L.
Oxygen Consumption and Ammonia and Phosphate Excretion in Pond Zooplankton,
W83-00571 2H

PUGH, C. A.
Penstock Entrance Research- Auburn Dam Entrance,
W83-00638 8A

PYPER, G. E.
Surface-Water and Climatological Data, Salt Lake County, Utah, Water Year 1980,
W83-00559 7C

QUIRK, M.
The Seasonal Cycle of Inorganic Carbon Species in Cazenovia Lake, New York, 1977,
W83-00532 2H

RACE, M. S.
Coastal Zone Development: Mitigation, Marsh Creation, and Decision-Making,
W83-00430 6G

RAI, H.
Establishing the Pattern of Heterotrophic Bacterial Activity in Three Central Amazonian Lakes,
W83-00523 2H

RAINER, S. F.
Benthic Communities in an Estuary with Periodic Deoxygenation,
W83-00407 2L

RAINS, D. W.
Agriculture,
W83-00540 3F

RAMANO, L. S.
Composting Sewage Sludge by Means of Forced Aeration,
W83-00614 5E

RANDALL, A. D.
Geohydrology of the Valley-Fill Aquifer in the Elmira Area, Chemung County, New York,
W83-00695 7C

Geohydrology of the Valley-Fill Aquifer in the Endicott-Johnson City Area, Broome County, New York,
W83-00555 7C

RANGO, A.
Accuracy of Snowmelt Runoff Simulation,
W83-00370 2C

RAPP, D. H.
Specification for Procurement of Water-Level Sensing Instrumentation, Specification Number HIF-I-1,
W83-00684 7B

RAUERT, W.
Environmental Isotope Studies of an Alpine Snowpack,
W83-00360 2C

REASONER, D. J.
Microbiology: Detection of Bacterial Pathogens and Their Occurrence,
W83-00658 5A

REDDINGTON, P.
The Construction of the Marchwiel Reservoir Using a High Density Polyethylene Lining,
W83-00504 8G

REED, S. A.
Desalting Seawater and Brackish Waters: 1981 Cost Update,
W83-00642 3A

REHEIS, H. F.
Treatment Costs Savings Through Monthly Variable Effluent Limits,
W83-00660 6F

REINWARTH, O.
Glacial-Hydrological Investigations at the Vernagtferner Glacier as a Basis for a Discharge Model,
W83-00379 2A

REYNOLDS, B. P.
The Construction of the Marchwiel Reservoir Using a High Density Polyethylene Lining,
W83-00504 8G

RHEAD, M. M.
Rapid Screening Technique Utilising High-Performance Liquid Chromatography for Assessing Acrylamide Contamination in Effluents,
W83-00381 5A

The Use of Uric Acid as a Method of Tracing Domestic Sewage Discharges in Riverine, Estuarine and Coastal Water Environments,
W83-00646 5A

RICH, L. G.
Benthal Stabilization of Waste Activated Sludge,
W83-00679 5E

RICHARDS, A. H.
Determination of Arsenic in Potable, Fresh and Estuarine Water by Flameless Atomic Absorption,
W83-00405 5A

Determination of Dissolved Selenium in Fresh and Estuarine Waters by Flameless Atomic Absorption,
W83-00404 5A

RIENECKER, M. M.
A Fourier Method for Solving Nonlinear Water-Wave Problems: Application to Solitary-Wave Interactions,
W83-00514 8B

RINELLA, F. A.
Dissolved-Oxygen and Algal Conditions in Selected Locations of the Willamette River Basin, Oregon,
W83-00696 5A

RITTER, J. R.
An Evaluation of Water-Quality Monitoring in the Brandywine Creek Basin, Pennsylavania, 1973-78,
W83-00560 7C

ROBERTS, H. D.
Model Protocol for the Comprehensive Evaluation of Publicly Owned Treatment Works Performance and Operation,
W83-00631 5D

ROBERTS, M. H. JR.
Kepone Distribution in Selected Tissues of Blue Crabs, Callinectes Sapidus, Collected From the James River and Lower Chesapeake Bay,
W83-00436 5B

ROBERTS, P. J. W.
Mixing and Transport,
W83-00478 5B

ROBERTSON, F. N.
Deep Oxygenated Ground Water: Anomaly or Common Occurrence.,
W83-00565 2F

ROBILLARD, L.
Convective Response of a Mass of Water Near 4 C to a Constant Cooling Rate Applied on Its Boundaries,
W83-00512 8B

RODGERS, D. R.
Control of Algal Filamentous Bulking at the Southerly Wastewater Treatment Plant,
W83-00369 5D

ROLAND, L. D.
Some Options for Treating Liquid Wastes From Nitrogen Fertilizer Factories,
W83-00440 5D

ROOS, C.
Halocarbons as Tracer Substances in Studies of the Distribution Patterns of Chlorinated Waters in Coastal Areas,
W83-00435 5B

ROSCHER, N. M.
Determining Free Available Chlorine by DPD-Colorimetric, DPD-Steadifac (Colorimetric), and Facts Procedures,
W83-00453 5A

ROSS, R. G.
Pollution From US Explosives and Propellants Production,
W83-00441 5D

ROTT, H.
Evapotranspiration at Two Mountain Sites During the Vegetation Period,
W83-00352 2D

ROWE, L. K.
Low Flow Water Chemistry in Forested and Pasture Catchments, Mawheraiti River, Westland,
W83-00568 5B

ROZICH, A. F.
Control of Algal Filamentous Bulking at the Southerly Wastewater Treatment Plant,
W83-00369 5D

RUEDISILI, L. C.
Beyond Section 858: A Proposed Ground-Water Liability and Management System for the Eastern United States,
W83-00439 6E

RUSIN, I. N.
Effect of Variability of River Runoff on Seawater Intrusion Into River Mouths,
W83-00673 2L

RUTZEL, H.
An Automatic Voltammetric Analyzer for the Simultaneous Determination of Toxic Trace Metals in Water,
W83-00510 7B

RUUHIJARVI, J.
Carbon, Phosphorus and Nitrogen Budgets of the Littoral Equisetum Belt in an Oligotrophic Lake,
W83-00522 2H

RYALS, G. N.
Regional Geohydrology of the Northern Louisian Salt-Dome Basin, Part I, Conceptual Model and Data Needs,
W83-00691 2F

SAET, Y. E.
Effect of Industrial-Residential Zones on Water Quality of Surface Streams,
W83-00460 5B

SAHM, H.
Anaerobic Treatment of an Industrial Wastewater Containing Acetic Acid, Furfural, and Sulphite,
W83-00587 5D

SARVALA, J.
Carbon, Phosphorus and Nitrogen Budgets of the Littoral Equisetum Belt in an Oligotrophic Lake,
W83-00522 2H

SCHAEFFER, D. J.
Water Quality Monitoring: What Directions Should New Programs Take,
W83-00429 5A

SCHAIBERGER, G. E.
Distribution of Enteroviruses in Sediments Contiguous With a Deep Marine Sewage Outfall,
W83-00645 5B

SCHAUB, S. A.
Fate of Virus in Wastewater Applied to Slow-Infiltration Land Treatment Systems,
W83-00386 5B

SCHAUF, F.
Survey of On-Going and Completed Remedial Action Projects,
W83-00637 5G

SCHNEIDER, M.
Investigation on the Microbiology of the Saar River (Untersuchung Zur Microbiologie Der Saar),
W83-00649 5B

SCHNEIDER, T. R.
Abnormal Behaviour of Zeuzier Arch-Dam (Switzerland), IV. Geological Aspects of the Extraordinary Behaviour of Zeuzier Arch Dam,
W83-00365 8A

SCHOBERTH, S. M.
Anaerobic Treatment of an Industrial Wastewater Containing Acetic Acid, Furfural, and Sulphite,
W83-00587 5D

SCHROEDER, E. D.
Performance of Trickling Filter Plants: Reliability, Stability and Variability,
W83-00634 5D

SCHUK, W.
Operation and Maintenance of Wastewater Systems Including Instrumentation and Automation,
W83-00481 5D

SCORGIE, H. R. A.
Growth and Recession of Aquatic Macrophytes on a Shaded Section of the River Lambourn, England, From 1971 to 1980,
W83-00520 2I

SCOTT, G. A.
Piping Potential of Weak Zones Under Concrete Dams,
W83-00356 8A

SCOTT, J. C.
Flow Beneath a Stagnant Film on Water: The Reynolds Ridge,
W83-00516 8B

SEELYE, J. G.
Accumulation by Fish of Contaminants Released From Dredged Sediments,
W83-00449 5B

SEIDEL, K.
Snow Surface Measurements From Digital Landsat MSS Data,
W83-00362 7C

SELLERS, P. J.
A Computer Simulation of the Effects of Differing Crop Types on the Water Balance of Small Catchments Over Long Time Periods,
W83-00585 2D

SEPERS, A. B. J.
Comparison Between the Carbon-14 and Oxygen Consumption Method for the Determi-

nation of the Activity of Heterotrophic Bacterial Populations,
W83-00569 2H

SERGIYENKO, A. I.
Ecological Assessment of Water Quality in the Estuarine Region of the Danube,
W83-00602 5B

SEVERENCHUK, N. S.
The Feeding of Kanev Reservoir Fishes in Connection With the Discharge of Heated Water From the Tripol'ye Power Station,
W83-00598 5C

SHAN, A.
Development of Analytical Test Procedures for Organic Pollutants in Wastewater - Application to Pesticides,
W83-00632 5A

SHARRETT, A. R.
Components of Variation in Lead, Cadmium, Copper, and Zinc Concentration in Home Drinking Water: The Seattle Study of Trace Metal Exposure,
W83-00432 5A

Daily Intake of Lead, Cadmium, Copper, and Zinc From Drinking Water: The Seattle Study of Trace Metal Exposure,
W83-00431 5B

SHKUNDINA, F. B.
Diel Dynamics of Phytoplankton in Lake Kandry-Kul,
W83-00578 2H

SILSBEE, D. G.
Bacterial Water Quality: Springs and Streams in the Great Smoky Mountains National Park,
W83-00426 5A

SILVER, M.
Oil Spill Cleanup Fulfills Aim of Federal Water Pollution Control Act,
W83-00566 5G

SIMMONS, M. D.
Remedial Treatment Exploration, Wolf Creek Dam, KY,
W83-00651 8E

SINEMUS, H. W.
Influence of Valence State on the Determination of Antimony, Arsenic, Bismuth, Selenium and Tellurium in Lake Water Using the Hydride AA Technique,
W83-00403 5A

SINGLETON, F. L.
Diluent Composition for Use of API 20E in Characterizing Marine and Estuarine Bacteria,
W83-00388 5A

SIPOS, L.
An Automatic Voltammetric Analyzer for the Simultaneous Determination of Toxic Trace Metals in Water,
W83-00510 7B

SIVIOUR, N. G.
Removing Metals From Waste Solutions With Low Rank Coals and Related Materials,
W83-00471 5D

SKOGERBOE, G. V.
Development Process for Improving Irrigation Water Management,
W83-00458 3F

SLAYMAKER, H. O.
Effect of Scale on the Complexity of Snowmelt Systems,
W83-00375 2C

SLIFKER, R. A.
Determining Free Available Chlorine by DPD-Colorimetric, DPD-Steadifac (Colorimetric), and Facts Procedures,
W83-00453 5A

SLOTO, R. A.
A Stormwater Management Model for the West Branch Brandywine Creek, Chester County, Pennsylvania,
W83-00562 4A

SMITH, C. A.
Brighten the Beds,
W83-00442 5D

Data on Selected Deep Wells in South Florida,
W83-00689 7C

SMITH, P. B.
Mains Infestation Control Using Permethrin,
W83-00498 5F

SMITH, R.
Use of a Hydride-Generation Technique for the Atomic Absorption Determination of Lead in Drinking Water,
W83-00401 5A

SMITH, W.
Acoustic Systems for the Measurement of Streamflow,
W83-00692 7B

SNAVELY, D. S.
Availability of Water From Aquifers in Upstate New York,
W83-00681 7C

SOBSEY, M. D.
Evaluation of the Tentative Standard Method for Enteric Virus Concentration and Detection,
W83-00629 5A

SOMVILLE, M.
Influence of Temperature and River Discharge on Water Quality of the Western Scheldt Estuary,
W83-00669 5C

SONSTEGARD, R. A.
Bioaccumulation of Organochlorines by Yearling Coho Salmon (Oncorhynchus Kisutch Walbaum) Fed Diets Containing Great Lakes' Coho Salmon, and the Pathophysiological Responses of the Recipients,
W83-00418 5C

SOUTHWICK, J. W.
Community Health Associated With Arsenic in Drinking Water in Millard County, Utah,
W83-00630 5C

SPARLING, E. W.
Development Process for Improving Irrigation Water Management,
W83-00458 3F

SPRAY, P. R.
Groundwater Supply Exploration in Semi-Arid Regions for Livestock Extension--A Technical and Economic Appraisal,
W83-00459 6B

STALEY, J. T.
Widespread Distribution of Ability to Oxidize Manganese Among Freshwater Bacteria,
W83-00390 5B

STANNERS, D. A.
Desorption of Ru106, Cs134, Cs137, Ce144 and Am241 From Intertidal Sediment Contaminated by Nuclear Fuel Reprocessing Effluents,
W83-00437 5B

STAUDINGER, M.
Evapotranspiration at Two Mountain Sites During the Vegetation Period,
W83-00352 2D

STEIN, V. B.
Determination of Arsenic in Potable, Fresh and Estuarine Water by Flameless Atomic Absorption,
W83-00405 5A

Determination of Dissolved Selenium in Fresh and Estuarine Waters by Flameless Atomic Absorption,
W83-00404 5A

STELZ, W. B.
Geohydrology of the Valley-Fill Aquifer in the Cortland-Homer-Preble Area, Cortland and Onondaga Counties, New York,
W83-00697 7C

STELZ, W. G.
Geohydrology of the Glaciolacustrine Aquifer in the Fulton area, Oswego County, New York,
W83-00699 7C

Geohydrology of the Preglacial Genesee Valley, Monroe County, New York,
W83-00554 7C

Geohydrology of the Valley-Fill Aquifer in the Jamestown Area, Chautauqua County, New York,
W83-00564 7C

Geohydrology of the Valley-Fill Aquifer in the Ramapo and Mahwah Rivers Area, Rockland County, New York,
W83-00556 7C

STENT, R. F.
Grafham Water: A Discussion of Limnological Events During the 5-Year Period 1974-1978,
W83-00534 2H

STEPHENS, D. W.
Surface-Water and Climatological Data, Salt Lake County, Utah, Water Year 1980,
W83-00559 7C

STEWART, A. J.
Dissolved Humic Materials: Photodegradation, Sediment Effects, and Reactivity with Phosphate and Calcium Carbonate Precipitation,
W83-00397 2H

STICHLER, W.
Environmental Isotope Studies of an Alpine Snowpack,
W83-00360 2C

Isotope Input Into Runoff Systems From Melting Snow Covers,
W83-00374 2C

STOYANOV, K.
Extraction-Spectrophotometric Determination of Copper (II) with 4-(2-Pyridylazo) Resorcinol and a Long-Chain Quaternary Ammonium Salt,
W83-00354 5A

STRANGEWAYS, I.
Instruments for Mountainous Areas,
W83-00361 7B

SUPALLA, R. J.
Economic Evaluation of Groundwater Policy Alternatives in the Northern Great Plains,
W83-00623 4B

SUTTON, L. A.
EPA and Water Supply--Present and Future,
W83-00493 5G

SVYATSKII, A. Z.
Effect of Variability of River Runoff on Seawater Intrusion Into River Mouths,
W83-00673 2L

SWEENEY, R. A.
Lake Erie Cladophora in Perspective,
W83-00661 2H

SWINTON, E. A.
Colour and Turbidity Removal With Reusable Magnetic Particles-III Immobilized Metal Hydroxide Gels,
W83-00506 5F

SWITZENBAUM, M. S.
Biological Filters,
W83-00484 5D

SYKES, R. M.
Control of Algal Filamentous Bulking at the Southerly Wastewater Treatment Plant,
W83-00369 5D

TAMMINEN, T.
Winter Microbial Activity in Lake Tuusulanjarvi,
W83-00528 5G

TAY, J.-H.
Development of a Settling Model for Primary Settling Tanks,
W83-00671 5D

TAYLOR, G. W.
Fate of Virus in Wastewater Applied to Slow-Infiltration Land Treatment Systems,
W83-00386 5B

TAYLOR, M. R.
Water Resources and Environmental Planning Using Interactive Graphics,
W83-00456 6A

TCHOBANOGLOUS, G.
Performance of Trickling Filter Plants: Reliability, Stability and Variability,
W83-00634 5D

TEITZ, M. B.
Industry,
W83-00542 6D

TESTER, D. J.
Ground-Water Pollution Investigations in the Great Ouse Basin. II-Solid Waste Disposal,
W83-00507 5B

THAYER, J. S.
Factors Affecting the Toxic Effect of Tin on Estuarine Microorganisms,
W83-00393 5C

THORBORG, C. H.
Design and Construction of the Pennichuck Water Treatment Plant: The Equipment Supplier's View,
W83-00501 5F

TINKER, J.
The Character and Dispersal of Motorway Run-Off Water,
W83-00461 5B

TOEI, K.
Solvent Extraction of Molybdophosphate with Cationic Dyes and Spectrophotometric Determination of Micro Amounts of Phosphate in Waters,
W83-00355 5A

TOPPAN, W. C.
Emergency Response: A Case for Risk Determination,
W83-00494 5F

TRISCHAN, G.
Development of Analytical Test Procedures for Organic Pollutants in Wastewater - Application to Pesticides,
W83-00632 5A

TRUMP, C. L.
High Frequency Endogenous Periodicities of Chlorophyll Synthesis in Estuarine Phytoplankton,
W83-00570 2L

TSAI, G.-J.
Reverse Osmosis in an Unstirred Batch System. II. Analysis on Transport Phenomena Across Membrane,
W83-00583 3A

TSURUMI, M.
Self-Consistent Least-Squares Method of Estimating Chemical Composition of the Sources of Chemical Constituents in Natural Waters,
W83-00353 2K

TURNPENNY, A. W. H.
An Analysis of Mesh Sizes Required for Screening Fishes at Water Intakes,
W83-00450 8I

A Conductiometric Technique for Measuring the Water Velocity in Salmonid Spawning Beds,
W83-00644 2F

UDLUFT, P.
Hydrogeochemical Prospecting of Ore-Deposits, Demonstrated on Some Water Analyses From Peru. (Hydrogeochemische Prospektion Von Erzlagerstatten Dargestellt Anhand Einiger Wasseranalysen Aus Peru),
W83-00674 5B

UMEZAKI, Y.
Indirect Determination of Sub-ng Per ml-1 Levels of Phosphorus in Waters by Di-Isobutyl Ketone Extraction of Reduced Molybdoantimonylphosphoric Acid and Inductively-Coupled Plasma Emission Spectrometry,
W83-00380 5A

UTTORMARK, P. D.
Steady-State Ecosystem Modeling for Lake Management,
W83-00610 5G

VAATANEN, P.
Survival in Lake Water of Klebsiella Pneumoniae Discharged by a Paper Mill,
W83-00387 5B

VALENTA, P.
An Automatic Voltammetric Analyzer for the Simultaneous Determination of Toxic Trace Metals in Water,
W83-00510 7B

VAN DEN BERG, L.
Stability and Performance of Anaerobic Fixed Film Reactors During Hydraulic Overloading at 10-35C,
W83-00670 5D

VAN DEUSEN, C. W.
An Economic Evaluation of Citizen Suits,
W83-00619 6E

VASATA, P.
Phosphorus Reduction in a Man-Made Lake by Means of a Small Reservoir on the Inflow,
W83-00396 5G

VASHON, R. D.
The Effect of Water Hardness on Nitrilotriacetate Removal and Microbial Acclimation in Activated Sludge,
W83-00668 5D

VASICEK, P. R.
Use of a Kinetic Study to Optimize the Activated Sludge Process,
W83-00677 5D

VASIL'EV, V. S.
Comparative Evaluation of Mathematic Models Used for Calculating Aeration Tanks,
W83-00672 5D

VASSEUR, P.
Convective Response of a Mass of Water Near 4 C to a Constant Cooling Rate Applied on Its Boundaries,
W83-00512 8B

VAUX, H. J. JR.
The Economics of Water Allocation,
W83-00544 6E

VAVILIN, V. A.
Comparative Evaluation of Mathematic Models Used for Calculating Aeration Tanks,
W83-00672 5D

The Theory and Design of Aerobic Biological Treatment,
W83-00413 5D

VAZQUEZ, F.
The Density and Composition of Hypersaline Waters of a Mexican Lagoon,
W83-00572 2K

VELICHKO, I. M.
Ecological and Physiological Profile of Filamentous Green Algae as Factors in the Production of Organic Matter and Control of Water Quality,
W83-00576 2H

VELNICH, A. J.
Flood Data in West Windsor Township, Mercer County, New Jersey Through 1981 Water Year,
W83-00690 7C

VERDUIN, J.
Primary Productivity and Nutrient Balance in a Lower Colorado River Reservoir,
W83-00394 2H

VESILIND, P. A.
Sludge Treatment, Utilization, and Disposal,
W83-00483 5E

VON AMMON, F.
Interlaboratory Testing of the Leachability of Wastes and Sludges (Ringversuche zur Bestimmung Der Eluierbarkeit Von Abfallen und Schlammen Mit Wasser),
W83-00650 5B

WAKELEE, R. F.
Hydrologic Effects on Highway-Deicing Chemicals in Massachusetts,
W83-00558 5B

WAKIMOTO, T.
Solvent Extraction of Molybdophosphate with Cationic Dyes and Spectrophotometric Determination of Micro Amounts of Phosphate in Waters,
W83-00355 5A

WALKENSHAW, G. B.
Control of Algal Filamentous Bulking at the Southerly Wastewater Treatment Plant,
W83-00369 5D

WALKER, K. F.
Phosphorus and Nitrogen Loads in Waters Associated with River Murray Near Albury-Wodonga, and Their Effects on Phytoplankton Populations,
W83-00410 5C

WALKER, R. A.
Industry,
W83-00542 6D

WALKER, T. A.
Observations on Nitrate, Phosphate and Silicate in Cleveland Bay, Northern Queensland,
W83-00406 5A

WALLER, R. M.
Geohydrology of the Preglacial Genesee Valley, Monroe County, New York,
W83-00554 7C

WALSH, J.
Survey of On-Going and Completed Remedial Action Projects,
W83-00637 5G

WANG, L. K.
Pollution From US Explosives and Propellants Production,
W83-00441 5D

WANG, M. H.
Pollution From US Explosives and Propellants Production,
W83-00441 5D

WARD, R. C.
Water Quality Monitoring: What Directions Should New Programs Take,
W83-00429 5A

WARREN, I. C.
Swimming Pool Water Treatment in the UK,
W83-00470 5F

WASLENCHUK, D. G.
The Concentration, Reactivity and Fate of Copper, Nickel and Zinc Associated with a Cooling-Water Plume in Estuarine Waters,
W83-00443 5B

WATKINS, D. W.
A Comparison of the Carrousel and Pasveer Ditch Activated Sludge Plant,
W83-00476 5D

WATTS, D. G.
Improvement of Irrigation Scheduling Techniques for Corn With Variable Corn Maturity Range, Plant Population and Water Supply Availability,
W83-00624 3F

WEAND, B. L.
Non-Point Sources,
W83-00479 5B

WEATHERBE, D. G.
Urban Runoff Control Technology,
W83-00416 5D

WEATHERSPOON, D. M.
Drip Tested on Florida Ornamentals, Evaluation of Drip Irrigation for Container Production of Woody Landscape Plants,
W83-00591 3F

WECKESSER, S.
'Plain Meaning' Decision Clarifies Standard for Effluent Limitations,
W83-00567 6E

WEINBERGER, P.
Fate of Fenitrothion in Aquatic Microcosms and the Role of Aquatic Plants,
W83-00448 5B

WEISS, D. E.
Colour and Turbidity Removal With Reusable Magnetic Particles-III Immobilized Metal Hydroxide Gels,
W83-00506 5F

WELZ, B.
Influence of Valence State on the Determination of Antimony, Arsenic, Bismuth, Selenium and Tellurium in Lake Water Using the Hydride AA Technique,
W83-00403 5A

WERNER, C.
Municipal and Domestic Use,
W83-00541 6D

WESTERN, A. E.
Community Health Associated With Arsenic in Drinking Water in Millard County, Utah,
W83-00630 5C

WETZEL, R. G.
Dissolved Humic Materials: Photodegradation, Sediment Effects, and Reactivity with Phosphate and Calcium Carbonate Precipitation,
W83-00397 2H

WHEATSTONE, K. C.
Extraction and Analysis of Interstitial Water From Sandstone,
W83-00382 5A

WHITLEY, J.
Community Health Associated With Arsenic in Drinking Water in Millard County, Utah,
W83-00630 5C

WILLE, S. A.
Dissolved-Oxygen and Algal Conditions in Selected Locations of the Willamette River Basin, Oregon,
W83-00696 5A

WILLIAMS, R.
A Conductiometric Technique for Measuring the Water Velocity in Salmonid Spawning Beds,
W83-00644 2F

WINOGRAD, I. J.
Deep Oxygenated Ground Water: Anomaly or Common Occurrence.,
W83-00565 2F

WITZEL, K.-P.
Microbial Communities in Lake Plussee--An Analysis With Numerical Taxonomy of Isolates,
W83-00399 2H

WONG, J.
An Index of Littoral Zone Complexity and Its Measurement,
W83-00414 2H

WONG, W.
Evaluation of the Performance of a Combined Sewer Overflow Retention Tank,
W83-00627 5D

WOOTTON, M.
Metal Levels in the Mussel Mytilus Edulis Collected from Estuaries in South-Eastern Australia,
W83-00411 5A

WORD, D. M.
Treatment Costs Savings Through Monthly Variable Effluent Limits,
W83-00660 6F

WRIGHT, J.
Evaluation of Public Participation in the Yadkin-Pee Dee Level B River Basin Study,
W83-00612 6B

WRIGHT, W. C.
Decentralizing Water Resource Planning and Management,
W83-00454 6B

WRONA, F. J.
Effects of Chlorinated Sewage Effluents on Fish in the Sheep River, Alberta,
W83-00582 5C

WYLIE, G. D.
Evaluation of the River Die-Away Biodegradation Test,
W83-00492 5B

YEH, W. W.-G.
Estimation of Small-Scale Hydropower Potential,
W83-00357 6A

YEN, E. S.
Frozen Soil Effects on the Erosion Hazard,
W83-00615 2J

YOBBI, D. K.
Ground-Water Levels in Selected Well Fields and in West-Central Florida, September 1981,
W83-00685 7C

YOO, K. H.
Optimal Planning of Irrigation Distribution and Application Systems for a Large Irrigated Area,
W83-00616 3F

YOUNG, C. E.
The Economics of Municipal Wastewater Reuse,
W83-00465 6B

YOUNG, G. J.
Meltwater Hydrology and Hydrochemistry in Snow- and Ice-Covered Mountain Catchments,
W83-00377 2C

YOUNG, H. W.
Thermal Springs in the Salmon River Basin, Central Idaho,
W83-00552 1A

YRJANA, E. -R.
The Role of Nitrogen as a Growth Limiting Factor in the Eutrophic Lake Vesijarvi, Southern Finland,
W83-00604 2H

ZAISS, U.
Investigation on the Microbiology of the Saar River (Untersuchung Zur Microbiologie Der Saar),
W83-00649 5B

ZAMAN, M.
The Ganges Basin and the Water Dispute,
W83-00455 4A

ZEITZEW, H.
Legal Liability of Reclaimed Water System Proprietors,
W83-00620 6E

ZEMANSKY, G. M.
Adjudicatory Hearings as Part of the NPDES Hearing Process,
W83-00424 6E

ZERBE, R. O. JR.
Adjudicatory Hearings as Part of the NPDES Hearing Process,
W83-00424 6E

ZOLTEK, J. JR.
Physical and Chemical Methods,
W83-00486 5D

ZUKOVS, G.
Evaluation of the Performance of a Combined Sewer Overflow Retention Tank,
W83-00627 5D

Urban Runoff Control Technology,
W83-00416 5D

ORGANIZATIONAL INDEX

ADELAIDE UNIV. (AUSTRALIA). DEPT. OF ZOOLOGY.
Phosphorus and Nitrogen Loads in Waters Associated with River Murray Near Albury-Wodonga, and Their Effects on Phytoplankton Populations,
W83-00410 5C

AGRICULTURAL RESEARCH CENTER, MONTICELLO, FL.
Drip Tested on Florida Ornamentals, Evaluation of Drip Irrigation for Container Production of Woody Landscape Plants,
W83-00591 3F

AKADEMIYA NAUK SSSR, BOROK. INST. BIOLOGII VNUTRENNYKH VOD.
Destruction of Organic Matter by Higher Water Plants Under Experimental Conditions,
W83-00597 2H

AKADEMIYA NAUK SSSR, MOSCOW. INST. VODNYKH PROBLEM.
The Theory and Design of Aerobic Biological Treatment,
W83-00413 5D

AKADEMIYA NAUK SSSR, NOVOSIBIRSK. INST. OF LIMNOLOGICAL.
Interaction of Bacterial Plankton and Zooplankton in Oligotrophic Water Bodies,
W83-00648 2H

AKADEMIYA NAUK SSSR, TOLYATTI. INST. BIOLOGII VNUTRENNYKH VOD.
Phytophilous Assemblages of Organisms in Saratov Reservoir,
W83-00579 2H

AKADEMIYA NAUK URSR, KIEV. INST. HIDROBIOLOGII.
Ecological and Physiological Profile of Filamentous Green Algae as Factors in the Production of Organic Matter and Control of Water Quality,
W83-00576 2H

The Impact of Damming the Don River on the Natural Reproduction of the Diadromous Shad,
W83-00593 6G

Survival and Growth of Phytophagous Fish as a Function of Oxygen Concentration in Water,
W83-00594 5C

The Feeding of Kanev Reservoir Fishes in Connection With the Discharge of Heated Water From the Tripol'ye Power Station,
W83-00598 5C

The Main Approaches to the Study of the Cycle of Biological Elements in the Dnieper Reservoirs,
W83-00599 5B

The Forms in Which Manganese Migrates in the Water of the Dnieper and the Desna,
W83-00601 5B

ALBERTA UNIV., EDMONTON. DEPT. OF CIVIL ENGINEERING.
Factors Limiting Emulsified Lipid Treatment Capacity of Activated Sludge,
W83-00499 5D

ANGLIAN WATER AUTHORITY (ENGLAND).
Grafham Water: A Discussion of Limnological Events During the 5-Year Period 1974-1978,
W83-00534 2H

ARIZONA STATE UNIV., TEMPE. DEPT. OF GEOGRAPHY.
Tamarisk and River-Channel Management,
W83-00428 4A

ARIZONA STATE UNIV., TEMPE. DEPT. OF ZOOLOGY.
Physical and Chemical Features of Playa Lakes in Southeastern California, USA,
W83-00372 2H

ARIZONA UNIV., TUCSON. SCHOOL OF RENEWABLE NATURAL RESOURCES.
Simulation of Nutrient and Heavy Metal Transport Capacity of Suspended Sediment,
W83-00609 4D

ARMY ENGINEER DISTRICT, NASHVILLE, TN.
Remedial Treatment Exploration, Wolf Creek Dam, KY,
W83-00651 8E

ARMY MEDICAL BIOENGINEERING RESEARCH AND DEVELOPMENT LAB., FORT DETRICK, MD.
Fate of Virus in Wastewater Applied to Slow-Infiltration Land Treatment Systems,
W83-00386 5B

ASTON UNIV., BIRMINGHAM (ENGLAND). DEPT. OF BIOLOGICAL SCIENCES.
Biological Surveillance of Rivers,
W83-00472 5A

Some Effects of Organic Pollution on the Distribution and Seasonal Incidence of Chironomidae in Riffles in the River Cole,
W83-00539 5C

AUBURN UNIV., AL. DEPT. OF FISHERIES AND ALLIED AQUACULTURES.
Managing Water Quality in Channel Catfish Ponds,
W83-00666 5G

BARCELONA UNIV. (SPAIN).
Stability of Chlorine Dioxide in Aqueous Solution,
W83-00667 5D

BATTELLE NORTHWEST, RICHLAND, WA.
Physical and Chemical Characteristics of Synthetic Asphalt Produced From Liquefaction of Sewage Sludge,
W83-00636 5E

BERGEN UNIV. (NORWAY). GEOFISISK INST.
Measuring and Modelling Snowmelt in Dyrdalen, Western Norway, 1979 and 1980,
W83-00376 2C

BRITISH QUARRYING AND SLAG FEDERATION LTD., CROYDON (ENGLAND).
Lime in Wastewater Treatment,
W83-00427 5D

BROWN AND CALDWELL, PASADENA, CA.
Legal Liability of Reclaimed Water System Proprietors,
W83-00620 6E

BROWNE (F. X.) ASSOCIATES, INC., LANSDALE, PA.
Non-Point Sources,
W83-00479 5B

BRUSSELS UNIV. (BELGIUM). LAB. OF OCEANOGRAPHY.
Influence of Temperature and River Discharge on Water Quality of the Western Scheldt Estuary,
W83-00669 5C

BUREAU OF COMMERCIAL FISHERIES, ANN ARBOR, MI. GREAT LAKES FISHERY LAB.
Accumulation by Fish of Contaminants Released From Dredged Sediments,
W83-00449 5B

BUREAU OF RECLAMATION, DENVER, CO.
Piping Potential of Weak Zones Under Concrete Dams,
W83-00356 8A

Characteristics and Application of Big Sandy River, Glenwood Springs, and Dotsero Springs Waters in Energy Development,
W83-00639 3C

BUREAU OF RECLAMATION, DENVER, CO. APPLIED SCIENCES BRANCH.
Installation of Flexible Membrane Lining in Mt. Elbert Forebay Reservoir,
W83-00641 8G

BUREAU OF RECLAMATION, DENVER, CO. ENGINEERING AND RESEARCH CENTER.
Penstock Entrance Research- Auburn Dam Entrance,
W83-00638 8A

CALGARY UNIV. (ALBERTA). DEPT. OF BIOLOGY.
Effects of Chlorinated Sewage Effluents on Fish in the Sheep River, Alberta,
W83-00582 5C

CALIFORNIA STATE UNIV., FRESNO. DEPT. OF VITICULTURE.
Drip vs. Flood--Viticulture Research: A Comparison of Two Irrigation Systems in California Vineyards,
W83-00588 3F

CALIFORNIA UNIV., BERKELEY.
Municipal and Domestic Use,
W83-00541 6D

Industry,
W83-00542 6D

Energy,
W83-00543 6C

CALIFORNIA UNIV., BERKELEY. SCHOOL OF LAW.
Protecting Streamflows in California,
W83-00425 6E

CALIFORNIA UNIV., DAVIS.
Agriculture,
W83-00540 3F

The Economics of Water Allocation,
W83-00544 6E

Performance of Trickling Filter Plants: Reliability, Stability and Variability,
W83-00634 5D

CALIFORNIA UNIV., DAVIS. DEPT. OF CIVIL ENGINEERING.
Improvement of Nonlinear Rainfall-Runoff Model,
W83-00654 2A

CALIFORNIA UNIV., DAVIS. DEPT. OF LAND, AIR AND WATER RESOURCES.
Evapotranspiration From Riparian Vegetation: Water Relations and Irrecoverable Losses for Saltcedar,
W83-00663 3B

Evapotranspiration From Riparian Vegetation: Conserving Water by Reducing Saltcedar Transpiration,
W83-00664 3B

CALIFORNIA UNIV., LOS ANGELES. SCHOOL OF ENGINEERING AND APPLIED SCIENCE.
Estimation of Small-Scale Hydropower Potential,
W83-00357 6A

CAMBRIDGE UNIV. (ENGLAND). DEPT. OF APPLIED BIOLOGY.

CAMBRIDGE UNIV. (ENGLAND). DEPT. OF APPLIED BIOLOGY.
Species Associations and Metal Contents of Algae From Rivers Polluted by Heavy Metals,
W83-00537 5C

Metal Resistances of Chlorophyta From Rivers Polluted by Heavy Metals,
W83-00538 5C

CAMP DRESSER AND MCKEE INC., DENVER, CO.
Rapid Infiltration Treatment of Primary and Secondary Effluents,
W83-00358 5D

CANADA CENTER FOR INLAND WATERS, BURLINGTON (ONTARIO).
Chlorobenzenes in Sediments, Water, and Selected Fish From Lakes Superior, Huron, Erie, and Ontario,
W83-00444 5B

CANADA CENTRE FOR INLAND WATERS, BURLINGTON (ONTARIO).
Practical Application of Linear Programming and Network Flows - Proceedings of the Technology Transfer Workshop.
W83-00628 6A

CAULFIELD INST. OF TECH. (AUSTRALIA). DEPT. OF CHEMISTRY.
Trace Metal Speciation in Three Victorian Lakes,
W83-00412 5A

CENTRAL ELECTRICITY GENERATING BOARD SOUTHAMPTON (ENGLAND). MARINE BIOLOGICAL LAB.
An Analysis of Mesh Sizes Required for Screening Fishes at Water Intakes,
W83-00450 8I

CENTRAL RESEARCH INST. ON THE MULTI-PURPOSE USE OF WATER RESOURCES, KIEV (USSR).
Ecological Assessment of Water Quality in the Estuarine Region of the Danube,
W83-00602 5B

CESKOSLOVENSKA AKADEMIE VED, PRAGUE. INST. OF LANDSCAPE ECOLOGY.
Oxygen Consumption and Ammonia and Phosphate Excretion in Pond Zooplankton,
W83-00571 2H

CINCINNATI, OHIO, HEALTH EFFECTS RESEARCH LAB., CINCINNATI, OH.
Health Effects Associated With Wastewater Treatment and Disposal,
W83-00371 5C

CLARK (DAVID) AND ASSOCIATES, INC., WASHINGTON, DC.
Probability of Annual Flows of the Greater Zab River,
W83-00457 2E

CLEMSON UNIV., SC. DEPT. OF ECONOMICS.
An Economic Evaluation of Citizen Suits,
W83-00619 6E

CLEMSON UNIV., SC. DEPT. OF ENVIRONMENTAL SYSTEMS ENGINEERING.
Benthal Stabilization of Waste Activated Sludge,
W83-00679 5E

COLORADO DIV. OF WILDLIFE, FORT COLLINS.
Studies of the Limnology, Fish Populations, and Fishery of Turquoise Lake, Colorado - 1979-80,
W83-00640 2H

COLORADO STATE UNIV., FORT COLLINS. DEPT. OF AGRICULTURAL AND CHEMICAL ENGINEERING.
Water Quality Monitoring: What Directions Should New Programs Take,
W83-00429 5A

COLORADO STATE UNIV., FORT COLLINS. DEPT. OF AGRICULTURAL ENGINEERING.
Development Process for Improving Irrigation Water Management,
W83-00458 3F

COLORADO UNIV., BOULDER.
Eutrophication,
W83-00477 5C

COMMONWEALTH SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANIZATION, CRONULLA (AUSTRALIA). DIV. OF FISHERIES AND OCEANOGRAPHY.
Benthic Communities in an Estuary with Periodic Deoxygenation,
W83-00407 2L

Cation-Exchange Behaviour of a Range of Adsorbents and Chromatographic Supports With Regard to Their Suitability for Investigating Trace Metal S peciation in Natural Waters,
W83-00517 5A

COMMONWEALTH SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANIZATION, MELBOURNE (AUSTRALIA).
Colour and Turbidity Removal With Reusable Magnetic Particles-III Immobilized Metal Hydroxide Gels,
W83-00506 5F

CONNECTICUT UNIV., GROTON. DEPT. OF MARINE SCIENCES.
The Concentration, Reactivity and Fate of Copper, Nickel and Zinc Associated with a Cooling-Water Plume in Estuarine Waters,
W83-00443 5B

CORNELL UNIV., ITHACA, NY.
Water Resources and Environmental Planning Using Interactive Graphics,
W83-00456 6A

CORNELL UNIV., ITHACA, NY. DEPT. OF AGRONOMY.
Factors Affecting the Toxic Effect of Tin on Estuarine Microorganisms,
W83-00393 5C

CULLEN (G. V.) AND ASSOCIATES, NORTH BALWYN (AUSTRALIA).
Removing Metals From Waste Solutions With Low Rank Coals and Related Materials,
W83-00471 5D

DARMOUTH COLL., HANOVER, NH. DEPT. OF EARTH SCIENCES.
Dynamics of Mixing in Estuaries,
W83-00420 2L

DELAWARE UNIV., NEWARK. DEPT. OF CIVIL ENGINEERING.
Control of Algal Filamentous Bulking at the Southerly Wastewater Treatment Plant,
W83-00369 5D

DELTA INST. OF HYDROBIOLOGICAL RESEARCH, YERSEKE (NETHERLANDS).
Comparison Between the Carbon-14 and Oxygen Consumption Method for the Determination of the Activity of Heterotrophic Bacterial Populations,
W83-00569 2H

DEPARTMENT OF AGRICULTURE, OTTAWA (ONTARIO). LAND RESOURCE RESEARCH INST.
Empirical Relations Between Soil Components and Water Retention at 1/3 and 15 Atmospheres,
W83-00415 2G

DEPARTMENT OF SCIENTIFIC AND INDUSTRIAL RESEARCH, TAUPO (NEW ZEALAND). FRESHWATER SECTION.
Primary Productivity and Nutrient Balance in a Lower Colorado River Reservoir,
W83-00394 2H

DEPARTMENT OF THE ENVIRONMENT, LONDON (ENGLAND), WATER RESEARCH DIRECTORATE.
Swimming Pool Water Treatment in the UK,
W83-00470 5F

DUKE UNIV. DURHAM, DEPT. OF CIVIL ENGINEERING.
Sludge Treatment, Utilization, and Disposal,
W83-00483 5E

ECOLE POLYTECHNIQUE, PALAISEAU (FRANCE). LAB. DE CHEMIE ANALYTIQUE PHYSIQUE.
Phthalate Ester Concentration Variations in Dated Sediment Cores From the Chesapeake Bay,
W83-00434 5B

ECOLOGY AND ENVIRONMENT, INC., BUFFALO, NY.
Lake Erie Cladophora in Perspective,
W83-00661 2H

EIDGENOESSISCHE TECHNISCHE HOCHSCHULE, ZURICH (SWITZERLAND).
Is Evaporation an Important Component in High Alpine Hydrology.
W83-00373 2D

EIDGENOESSISCHE TECHNISCHE HOCHSCHULE, ZURICH (SWITZERLAND). INST. FOR COMMUNICATION TECHNOLOGY.
Snow Surface Measurements From Digital Landsat MSS Data,
W83-00362 7C

EIDGENOESSISCHE TECHNISCHE HOCHSCHULE, ZURICH (SWITZERLAND). LAB. OF HY DRAULICS HYDROLOGY AND GLACIOLOGY.
Effect of Scale on the Complexity of Snowmelt Systems,
W83-00375 2C

EIDGENOESSISCHES AMT FUER WASSER IRTSCHAFT, BERN (SWITZERLAND).
Abnormal Behavior of Zeuzier Arch-Dam (Switzerland) I. General View,
W83-00508 8A

EIDGENOESSISCHES AMT FUER WASSERWIRTSCHAFT, BERN (SWITZERLAND).
Abnormal Behaviour of Zeuzier Arch-Dam (Switzerland) VII. Programs for Refilling and Monitoring,
W83-00368 8A

ENERGY RESOURCES CO., INC., CAMBRIDGE, MA.
Monitoring to Detect Groundwater Problems Resulting From Enhanced Oil Recovery,
W83-00635 5B

ENGINEERING-SCIENCE INC., AUSTIN, TX.
Velocity-Dependent Reaction Rates in a Slime Reactor,
W83-00359 5D

ENVIREX INC., WAUKESHA, WI.
Evaluation and Comparison of Digester Gas Mixing Systems,
W83-00500 5D

ENVIRONMENTAL PROTECTION AGENCY, BOSTON, MA.
EPA and Water Supply--Present and Future,
W83-00493 5G

ENVIRONMENTAL PROTECTION AGENCY, CINCINNATI, OH. DRINKING WATER RESEARCH DIV.
Microbiology: Detection of Bacterial Pathogens and Their Occurrence,
W83-00658 5A

ENVIRONMENTAL PROTECTION AGENCY, DALLAS, TX. REGION VI.
Microbiology of Potable Water and Ground Water,
W83-00655 5F

ESSEX UNIV., COLCHESTER (ENGLAND). DEPT. OF BIOLOGY.
Microbial Metabolism of Acetate, Propionate, and Butyrate in Anoxic Sediment From the Colne Point Saltmarsh, Essex, U.K.,
W83-00519 2L

ESSEX UNIV., COLCHESTER (ENGLAND). FLUID MECHANICS RESEARCH INST.
Flow Beneath a Stagnant Film on Water: The Reynolds Ridge,
W83-00516 8B

FLORIDA INTERNATIONAL UNIV., MIAMI.
Determining Free Available Chlorine by DPD-Colorimetric, DPD-Steadifac (Colorimetric), and Facts Procedures,
W83-00453 5A

FLORIDA UNIV., GAINESVILLE. DEPT. OF ENVIRONMENT ENGINEERING SCIENCES.
Physical and Chemical Methods,
W83-00486 5D

FOREST RESEARCH INST., CHRISTCHURCH (NEW ZEALAND).
Low Flow Water Chemistry in Forested and Pasture Catchments, Mawheraiti River, Westland,
W83-00568 5B

GANNETT, FLEMING, CORDDRY AND CARPENTER, INC., HARRISBURG, PA.
Model Protocol for the Comprehensive Evaluation of Publicly Owned Treatment Works Performance and Operation,
W83-00631 5D

GENERAL VACUUM SERVICES, WEST MIDLANDS (ENGLAND).
Vacuum Technology and Its Application in the Water Industry,
W83-00468 5E

GEOLOGICAL SURVEY, ALBANY, NY.
Geohydrology of the Valley-Fill Aquifer in the Ramapo and Mahwah Rivers Area, Rockland County, New York,
W83-00556 7C

GEOLOGICAL SURVEY, ALBANY, NY. WATER RESOURCES DIV.
Water Resources Data, New York, Water Year 1981--Volume 1. Eastern New York Excluding Long Island.
W83-00549 7C

Geohydrology of the Preglacial Genesee Valley, Monroe County, New York,
W83-00554 7C

Geohydrology of the Valley-Fill Aquifer in the Endicott-Johnson City Area, Broome County, New York,
W83-00555 7C

Geohydrology of the Valley-Fill Aquifer in the Jamestown Area, Chautauqua County, New York,
W83-00564 7C

Availability of Water From Aquifers in Upstate New York,
W83-00681 7C

Geohydrology of the Valley-Fill Aquifer in the Elmira Area, Chemung County, New York,
W83-00695 7C

Geohydrology of the Valley-Fill Aquifer in the Cortland-Homer-Preble Area, Cortland and Onondaga Counties, New York,
W83-00697 7C

Geohydrology of the Valley-Fill Aquifer in the Sprout and Fishkill Creeks Area, Dutchess County, New York,
W83-00698 7C

Geohydrology of the Glaciolacustrine Aquifer in the Fulton area, Oswego County, New York,
W83-00699 7C

GEOLOGICAL SURVEY, ANCHORAGE, AK. WATER RESOURCES DIV.
Hydrologic Data From Test Wells and Low-Flow Investigations in the Middle Reach of the Eagle River Valley, Alaska, 1980-81,
W83-00682 7C

Aquifer Data From Four Wells in the Mendenhall Valley Near Juneau, Alaska,
W83-00686 7C

GEOLOGICAL SURVEY, BATON ROUGE, LA. WATER RESOURCES DIV.
Regional Geohydrology of the Northern Louisian Salt-Dome Basin, Part I, Conceptual Model and Data Needs,
W83-00691 2F

GEOLOGICAL SURVEY, BOISE, ID. WATER RESOURCES DIV.
Thermal Springs in the Salmon River Basin, Central Idaho,
W83-00552 1A

Ground-Water Quality in East-Central Idaho Valleys,
W83-00694 7C

GEOLOGICAL SURVEY, BOSTON, MA.
Contamination of a Glacial Aquifer at Pease Air Force Base, Portsmouth, New Hampshire,
W83-00495 5B

GEOLOGICAL SURVEY, BOSTON, MA. WATER RESOURCES DIV.
Hydrologic Effects on Highway-Deicing Chemicals in Massachusetts,
W83-00558 5B

Sewage Plume in a Sand and Gravel Aquifer, Cape Cod, Massachusetts,
W83-00688 5B

GEOLOGICAL SURVEY, COLUMBUS, OH. WATER RESOURCES DIV.
Low-Flow Characteristics of Ohio Streams,
W83-00563 7C

GEOLOGICAL SURVEY, HARRISBURG, PA. WATER RESOURCES DIV.
An Evaluation of Water-Quality Monitoring in the Brandywine Creek Basin, Pennsylavania, 1973-78,
W83-00560 7C

A Stormwater Management Model for the West Branch Brandywine Creek, Chester County, Pennsylvania,
W83-00562 4A

GEOLOGICAL SURVEY, JACKSON, MS. WATER RESOURCES DIV.
Background Hydrologic Information in Potential Lignite Mining Areas in Mississippi, August 1980,
W83-00557 7C

Water Use in the Mississippi Gulf Coast Counties, 1980,
W83-00680 6D

Background Hydrologic Information in Potential Lignite Mining Areas in Mississippi, August 1981,
W83-00693 7C

GEOLOGICAL SURVEY, LAKEWOOD, CO. WATER RESOURCES DIV.
Statistical Summaries of Water-Quality Data for Two Coal Areas of Jackson County, Colorado,
W83-00550 7C

Hydrology and Chemical Quality of Ground Water in Kiowa County, Colorado,
W83-00561 7C

GEOLOGICAL SURVEY, LAWRENCE, KS. WATER RESOURCES DIV.
January 1981 Water Levels, and Data Related to Water-Level Changes, Western and South-Central Kansas,
W83-00553 7C

GEOLOGICAL SURVEY, MENLO PARK, CA. WATER RESOURCES DIV.
Observations From Moored Current Meters in San Francisco Bay, 1978.
W83-00551 7B

GEOLOGICAL SURVEY, NSTL STATION, MS. GULF COAST HYDROSCIENCE CENTER.
Infiltration Formulas by Curve Number Procedure,
W83-00653 2E

GEOLOGICAL SURVEY, NSTL STATION, MS. WATER RESOURCES DIV.
Data Management System for Urban Hydrology Studies Program,
W83-00683 7C

Specification for Procurement of Water-Level Sensing Instrumentation, Specification Number HIF-I-1,
W83-00684 7B

Computer Programs for Modeling Flow and Water Quality of Surface Water Systems,
W83-00687 2A

GEOLOGICAL SURVEY, PORTLAND, OR. WATER RESOURCES DIV.
Acoustic Systems for the Measurement of Streamflow,
W83-00692 7B

Dissolved-Oxygen and Algal Conditions in Selected Locations of the Willamette River Basin, Oregon,
W83-00696 5A

GEOLOGICAL SURVEY, RESTON, VA.
Deep Oxygenated Ground Water: Anomaly or Common Occurrence.,
W83-00565 2F

GEOLOGICAL SURVEY, SALT LAKE CITY, UT. WATER RESOURCES DIV.
Surface-Water and Climatological Data, Salt Lake County, Utah, Water Year 1980,
W83-00559 7C

GEOLOGICAL SURVEY, TACOMA, WA. WATER RESOURCES DIV.
Water Resources Data for Washington, Water Year 1980--Volume 2. Eastern Washington.
W83-00547 7C

Water Resources Data for Washington, Water Year 1980--Volume 1. Western Washington.
W83-00548 7C

GEOLOGICAL SURVEY, TALLAHASSEE, FL. WATER RESOURCES DIV.
Data on Selected Deep Wells in South Florida,
W83-00689 7C

GEOLOGICAL SURVEY, TAMPA, FL. WATER RESOURCES DIV.
Ground-Water Levels in Selected Well Fields and in West-Central Florida, September 1981,
W83-00685 7C

GEOLOGICAL SURVEY, TOWSON, MD. WATER RESOURCES DIV.
Water Resources Data for Maryland and Delaware, Water Year 1981.
W83-00700 7C

GEOLOGICAL SURVEY, TRENTON, NJ. WATER RESOURCES DIV.
Flood Data in West Windsor Township, Mercer County, New Jersey Through 1981 Water Year,
W83-00690 7C

GEOLOGICAL SURVEY, TUCSON, AZ. WATER RESOURCES DIV.
Water Resources Data for Arizona, Water Year 1980.
W83-00546 7C

GEORGIA INST. OF TECH., ATLANTA. SCHOOL OF CIVIL ENGINEERING.
Mixing and Transport,
W83-00478 5B

GESELLSCHAFT FUER STRAHLENFORSCHUNG M.B.H., MUNICH (GERMANY, F.R.). INST. FUER RADIOHYDROMETRIE.
Environmental Isotope Studies of an Alpine Snowpack,
W83-00360 2C

Glacial-Hydrological Investigations at the Vernagtferner Glacier as a Basis for a Discharge Model,
W83-00379 2A

GIDROMETEOROLOGICHESKII INST., LENINGRAD (USSR).
Effect of Variability of River Runoff on Seawater Intrusion Into River Mouths,
W83-00673 2L

GOETEBORG UNIV. (SWEDEN); AND CHALMERS UNIV. OF TECH., GOETEBORG (SWEDEN). DEPT. OF ANALYTICAL AND MARINE CHEMISTRY.
Halocarbons as Tracer Substances in Studies of the Distribution Patterns of Chlorinated Waters in Coastal Areas,
W83-00435 5B

GREAT SMOKY MOUNTAINS NATIONAL PARK, GATLINBURG, TN. UPLANDS FIELD RESEARCH LAB.
Bacterial Water Quality: Springs and Streams in the Great Smoky Mountains National Park,
W83-00426 5A

GUELPH UNIV. (ONTARIO). DEPT. OF ZOOLOGY.
Bioaccumulation of Organochlorines by Yearling Coho Salmon (Oncorhynchus Kisutch Walbaum) Fed Diets Containing Great Lakes' Coho Salmon, and the Pathophysiological Responses of the Recipients,
W83-00418 5C

HELSINKI UNIV. (FINLAND). DEPT. OF LIMNOLOGY.
Seasonal and Spatial Distribution of Humus Fractions in a Chain of Polyhumic Lakes in Southern Finland,
W83-00521 2H

HELSINKI UNIV. (FINLAND). DEPT. OF MICROBIOLOGY.
Survival in Lake Water of Klebsiella Pneumoniae Discharged by a Paper Mill,
W83-00387 5B

HELSINKI WATER DISTRICT (FINLAND).
Winter Microbial Activity in Lake Tuusulanjarvi,
W83-00528 5G

HERRERA ENVIRONMENTAL CONSULTANTS, SEATTLE, WA.
Evaluating the Potential for Contaminating Drinking Water From the Corrosion of Tin-Antimony Solder,
W83-00452 5B

HUNDTOFT (ELGIN B.), INC., HONOLULU, HI.
Composite Performance Charts for Drip Irrigation Tubing,
W83-00589 3F

HYDROBIOLOFICAL RESEARCH INST., JYVASKYLA UNIV. (FINLAND).
Nutrient Dependence of Phytoplankton Production in Brown-Water Lakes With Special Reference to Lake Paijanne,
W83-00524 5C

HYDRUALIC RESEARCH INST., PRAGUE (CZECHOSLOVAKIA).
Phosphorus Reduction in a Man-Made Lake by Means of a Small Reservoir on the Inflow,
W83-00396 5G

ICELAND UNIV., REYKJAVIK. INST. OF BIOLOGY.
The Palaeolimnology of Lake Myvatn, Northern Iceland; Plant and Animal Microfossils in the Sediment,
W83-00533 2H

IDAHO UNIV., MOSCOW. COLL. OF ENGINEERING.
Optimal Planning of Irrigation Distribution and Application Systems for a Large Irrigated Area,
W83-00616 3F

IDAHO UNIV., MOSCOW. DEPT. OF AGRICULTURAL ENGINEERING.
Frozen Soil Effects on the Erosion Hazard,
W83-00615 2J

IDAHO UNIV., MOSCOW. DEPT. OF FISHERY RESOURCES.
An Applied Coupled Simulation-Optimization Model of Water Use Efficiency in Intensive Fish Culture Systems,
W83-00617 8I

IFE UNIV. (NIGERIA). DEPT. OF GEOGRAPHY.
Predicting Depths to the Water Table in Deeply Weathered River Catchments in Nigeria,
W83-00497 2F

ILLINOIS INST. OF TECH., CHICAGO. PRITZKER DEPT. OF ENVIRONMENTAL ENGINEERING.
Disinfection,
W83-00487 5F

IMPERIAL COLLEGE OF SCIENCE AND TECHNOLOGY, LONDON (ENGLAND).
Influence of Bromide and Ammonia Upon the Formation of Trihalomethanes Under Water-Treatment Conditions,
W83-00447 5F

INFILCO DEGREMONT INC., RICHMOND, VA.
Design and Construction of the Pennichuck Water Treatment Plant: The Equipment Supplier's View,
W83-00501 5F

INNSBRUCK UNIV. (AUSTRIA). INST. FOR METEOROLOGY AND GEOPHYSICS.
Evapotranspiration at Two Mountain Sites During the Vegetation Period,
W83-00352 2D

INNSBRUCK UNIV. (AUSTRIA). INST. FOR PHYSICAL MEDICINE.
Application of the Gravity Flow Theory to the Percolation of Melt Water Through Firn,
W83-00513 2C

INSTITUT NATIONAL DE LA RECHERCHE AGRONOMIQUE, THONON-LES-BAINS (FRANCE). STATION D'HYDROBIOLOGIE LACUSTRE.
Excretion of Dissolved Organic Phosphorus in Tropical Brackish Waters,
W83-00419 2L

INSTITUT NATIONAL DE LA RECHERCHE SCIENTIFIQUE, SAINTE-FOY (QUEBEC). CENTRE DE L'ENERGIE.
High Frequency Endogenous Periodicities of Chlorophyll Synthesis in Estuarine Phytoplankton,
W83-00570 2L

INSTITUTE OF ECOLOGICAL TOXICOLOGY, BAIKAL (USSR).
Fundamental Principles of the Comparative Toxicological Experiment,
W83-00603 5C

INSTITUTE OF HYDROLOGY, WALLINGFORD (ENGLAND).
Instruments for Mountainous Areas,
W83-00361 7B

INTERSTATE ELECTRONICS CORP., ANAHEIM, CA. OCEAN SCIENCES DEPT.
Intertidal Community Offshore from the Werribee Sewage-Treatment Farm: An Opportunistic Infaunal Assemblage,
W83-00409 5C

IOWA STATE UNIV., AMES. DEPT. OF AGRICULTURAL ENGINEERING.
Site Evaluation, Design, Operation, and Installation of Home Sewage Systems in Iowa,
W83-00621 5D

Development of a Countywide Model Management Organization for Wastewater,
W83-00622 5D

IRKUTSKII GOSUDARSTVENNYI UNIV. (USSR). LAKE BAIKAL BIOLOGICAL STATION.
Biodegradation of Cellulose in Bottom Sediments of Lake Baikal,
W83-00600 5B

JAMES COOK UNIVERSITY OF NORTH QUEENSLAND, TOWNSVILLE (AUSTRALIA). SCHOOL OF BIOLOGICAL SCIENCES.
Observations on Nitrate, Phosphate and Silicate in Cleveland Bay, Northern Queensland,
W83-00406 5A

JOENSUU UNIV. (FINLAND). KARELIAN INST.
The Effect of Land Use on the Diatom Communities in Lakes,
W83-00530 5C

JORDAN, JONES AND GOULDING INC., ATLANTA, GA.
Treatment Costs Savings Through Monthly Variable Effluent Limits,
W83-00660 6F

JRC, VARESE (ITALY). RADIOCHEMISTRY DIV.
Desorption of Ru106, Cs134, Cs137, Ce144 and Am241 From Intertidal Sediment Contaminated by Nuclear Fuel Reprocessing Effluents,
W83-00437 5B

JYVASKYLA UNIV. (FINLAND). DEPT. OF BIOLOGY.
Seasonal Succession of Phytoplankton in an Ice-Free Pond Warmed by a Thermal Power Plant,
W83-00605 5C

KANSAS STATE UNIV., MANHATTAN. DEPT. OF CIVIL ENGINEERING.
Effect of Length of Fallow Period on Water Storage and Drainage,
W83-00618 3F

KERNFORSCHUNGSANLAGE JEULICH G.M.B.H. (GERMANY, F.R.). INST. FUER BIOTECHNOLOGIE 2.
Anaerobic Treatment of an Industrial Wastewater Containing Acetic Acid, Furfural, and Sulphite,
W83-00587 5D

KERNFORSCHUNGSANLAGE JUELICH G.M.B.H. (GERMANY, F.R.). INST. FUER ANGEWANDTE PHYSIKALISCHE CHEMIE.
An Automatic Voltammetric Analyzer for the Simultaneous Determination of Toxic Trace Metals in Water,
W83-00510 7B

KIEV POLYTECHNICAL INST. (USSR).
Chemiluminescence Method for the Determination of Trace Amounts of Proteins in Natural Waters,
W83-00580 5A

LAKE KARIBA FISHERIES RESEARCH INST. (ZIMBABWE).
The Influence of River Flow on Pelagic Sardine Catches in Lake Kariba,
W83-00518 2H

LEAGUE OF IOWA MUNICIPALITIES, DES MOINES.
New DEQ Water Policy More Receptive to City Needs,
W83-00423 5F

LEEDS UNIV. (ENGLAND). SCHOOL OF GEOGRAPHY.
Generation of Fecal and Total Coliform Surges by Stream Flow Manipulation in the Absence of Normal Hydrometeorological Stimuli,
W83-00385 5B

A Computer Simulation of the Effects of Differing Crop Types on the Water Balance of Small Catchments Over Long Time Periods,
W83-00585 2D

LEHIGH UNIV., BETHLEHEM, PA. CENTER FOR MARINE AND ENVIRONMENTAL STUDIES.
Operation and Maintenance of Wastewater Systems Including Instrumentation and Automation,
W83-00481 5D

LEHIGH UNIVERSITY, BETHLEHEM, PA. DEPT. OF CIVIL ENGINEERING.
Boundary Integral Solutions of Water Wave Problems,
W83-00463 8B

LIVERPOOL UNIV. (ENGLAND). DEPT. OF ZOOLOGY.
The Resorption of Zinc From Scales of Sea Trout (Salmo Trutta) During the Upstream Spawning Migration,
W83-00511 5B

LOS ANGELES BUREAU OF SANITATION, CA.
Operating Experience With Thermophilic Anaerobic Digestion,
W83-00490 5D

LOUGHBOROUGH UNIV. OF TECHNOLOGY (ENGLAND). DEPT. OF HUMAN SCIENCES.
Dispersion Patterns of Phytoplankton in Lakes,
W83-00581 2H

LUBBOCK CHRISTIAN COLL., TX. INST. OF WATER RESEARCH.
Lagoons and Oxidation Ponds,
W83-00485 5D

LUND UNIV. (SWEDEN). LIMNOLOGICAL INST.
The Limnological Basis for Planning Water Quality Management,
W83-00527 5G

MAINE DEPT. OF HUMAN SERVICE, AUGUSTA.
Emergency Response: A Case for Risk Determination,
W83-00494 5F

MAINE UNIV. AT ORONO. LAND AND WATER RESOURCES CENTER.
Steady-State Ecosystem Modeling for Lake Management,
W83-00610 5G

MANCHESTER WATER WORKS, NH.
National Drinking Water Advisory Council and Water Utility Council: What Do They Do.,
W83-00503 5G

MASSACHUSETTS UNIV., AMHERST. DEPT. OF CIVIL ENGINEERING.
Biological Filters,
W83-00484 5D

MASSACHUSETTS UNIV., AMHERST. WATER RESOURCES RESEARCH CENTER.
The Eutrophication of Cayuga Lake: A Historical Analysis of the Phytoplankton's Response to Phosphate Detergents,
W83-00509 5C

MASSEY UNIV., PALMERSTON NORTH (NEW ZEALAND). DEPT. OF MICROBIOLOGY AND GENETICS.
Amoebae From Antarctic Soil and Water,
W83-00389 5A

MAX-PLANCK-INST. FUER LIMNOLOGIE ZU PLOEN (GERMANY, F.R.).
Microbial Communities in Lake Plussee--An Analysis With Numerical Taxonomy of Isolates,
W83-00399 2H

Establishing the Pattern of Heterotrophic Bacterial Activity in Three Central Amazonian Lakes,
W83-00523 2H

METROPOLITAN SANITARY DISTRICT OF GREATER CHICAGO, IL.
Denitrification,
W83-00480 5D

MEXICO UNIV., MEXICO CITY.
The Density and Composition of Hypersaline Waters of a Mexican Lagoon,
W83-00572 2K

MIAMI UNIV., FL. DEPT. OF MICROBIOLOGY.
Distribution of Enteroviruses in Sediments Contiguous With a Deep Marine Sewage Outfall,
W83-00645 5B

MICHIGAN TECHNOLOGICAL UNIV., HOUGHTON. DEPT. OF CIVIL ENGINEERING.
Ecological Studies and Mathematical Modeling of Cladophora in Lake Huron: 3. The Dependence of Growth Rates on Internal Phosphorus Pool Size,
W83-00662 2H

MICHIGAN UNIV., ANN ARBOR. SCHOOL OF PUBLIC HEALTH.
Organic and Organotin Compounds Leached From PVC and CPVC Pipe,
W83-00633 5F

MIDWEST RESEARCH INST., KANSAS CITY, MO.
Development of Analytical Test Procedures for Organic Pollutants in Wastewater - Application to Pesticides,
W83-00632 5A

MINISTRY OF POWER, WATER RESOURCES AND FLOOD CONTROL, DACCA (BANGLADESH).
The Ganges Basin and the Water Dispute,
W83-00455 4A

MISSOURI UNIV.-COLUMBIA. DEPT. OF FISHERIES AND WILDLIFE.
Evaluation of the River Die-Away Biodegradation Test,
W83-00492 5B

MONTREAL UNIV. (QUEBEC). DEPT. OF CIVIL ENGINEERING.
Convective Response of a Mass of Water Near 4 C to a Constant Cooling Rate Applied on Its Boundaries,
W83-00512 8B

MOSCOW UNIV. (USSR).
The Structure and Abundance of Rybinsk Reservoir Zooplankton as a Function of the Concentration of Zinc and Chromium Compounds,
W83-00596 5C

MUNICIPAL ENVIRONMENTAL RESEARCH LAB., CINCINNATI, OH. DRINKING WATER RESEARCH DIV.
Analysis of Water Supply Costs in the Washington (D.C.) Area,
W83-00467 6B

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION, GREENBELT, MD. GODDARD SPACE FLIGHT CENTER.
Accuracy of Snowmelt Runoff Simulation,
W83-00370 2C

NATIONAL BOARD OF WATER, HELSINKI (FINLAND). WATER RESEARCH INST.
The Role of Nitrogen as a Growth Limiting Factor in the Eutrophic Lake Vesijarvi, Southern Finland,
W83-00604 2H

NATIONAL BOARD OF WATERS, HELSINKI (FINLAND).
An Oxygen Model for Lake Haukivesi,
W83-00525 5C

NATIONAL CHENG KUNG UNIV., TAINAN (TAIWAN). DEPT. OF ENVIRONMENTAL ENGINEERING.
Effect of EDTA on Cadmium in Activated Sludge Systems,
W83-00489 5D

NATIONAL ENERGY LAW AND POLICY INST., OK.
Beyond Section 858: A Proposed Ground-Water Liability and Management System for the Eastern United States,
W83-00439 6E

NATIONAL HEART, LUNG, AND BLOOD INST., BETHESDA, MD. EPIDEMIOLOGY AND BIOMETRY PROGRAM.
Daily Intake of Lead, Cadmium, Copper, and Zinc From Drinking Water: The Seattle Study of Trace Metal Exposure,
W83-00431 5B

Components of Variation in Lead, Cadmium, Copper, and Zinc Concentration in Home Drinking Water: The Seattle Study of Trace Metal Exposure,
W83-00432 5A

NATIONAL INST. FOR WATER RESEARCH, PRETORIA (SOUTH AFRICA).
Use of a Hydride-Generation Technique for the Atomic Absorption Determination of Lead in Drinking Water,
W83-00401 5A

NATIONAL RESEARCH COUNCIL OF CANADA, OTTAWA (ONTARIO). DIV. OF BIOLOGICAL SCIENCES.
Stability and Performance of Anaerobic Fixed Film Reactors During Hydraulic Overloading at 10-35C,
W83-00670 5D

NATIONAL RESEARCH INST. FOR POLLUTION AND RESOURCES, IBARAKI (JAPAN).
Indirect Determination of Sub-ng Per ml-1 Levels of Phosphorus in Waters by Di-Isobutyl Ketone Extraction of Reduced Molybdoantimonylphosphoric Acid and Inductively-Coupled Plasma Emission Spectrometry,
W83-00380 5A

NATIONAL TAIWAN UNIV., TAIPEI. DEPT. OF CHEMICAL ENGINEERING.
Reverse Osmosis in an Unstirred Batch System. II. Analysis on Transport Phenomena Across Membrane,
W83-00583 3A

NAVAL FACILITIES ENGINEERING COMMAND, PEARL HARBOR, HI. PACIFIC DIV.
Use of a Kinetic Study to Optimize the Activated Sludge Process,
W83-00677 5D

NEBRASKA UNIV.-LINCOLN. DEPT. OF AGRICULTURAL ECONOMICS.
Economic Evaluation of Groundwater Policy Alternatives in the Northern Great Plains,
W83-00623 4B

NEBRASKA UNIV.- LINCOLN. DEPT. OF AGRICULTURAL ENGINEERING.
Improvement of Irrigation Scheduling Techniques for Corn With Variable Corn Maturity Range, Plant Population and Water Supply Availability,
W83-00624 3F

NEW SOUTH WALES UNIV., KENSINGTON (AUSTRALIA). SCHOOL OF FOOD TECHNOLOGY.
Metal Levels in the Mussel Mytilus Edulis Collected from Estuaries in South-Eastern Australia,
W83-00411 5A

NEW SOUTH WALES UNIVERSITY, KENSINGTON (AUSTRALIA). SCHOOL OF MATHEMATICS.
A Fourier Method for Solving Nonlinear Water-Wave Problems: Application to Solitary-Wave Interactions,
W83-00514 8B

NEW YORK STATE DEPT. OF HEALTH, ALBANY. DIV. OF LABS. AND RESEARCH.
Determination of Dissolved Selenium in Fresh and Estuarine Waters by Flameless Atomic Absorption,
W83-00404 5A

Determination of Arsenic in Potable, Fresh and Estuarine Water by Flameless Atomic Absorption,
W83-00405 5A

NGK INSULATORS LTD., NAGOYA (JAPAN).
Pilot Plant Study on Sewage Sludge Pyrolysis-I,
W83-00647 5E

NORTH CAROLINA STATE UNIV. AT RALEIGH.
Evaluation of Public Participation in the Yadkin-Pee Dee Level B River Basin Study,
W83-00612 6B

NORTH CAROLINA UNIV. AT CHAPEL HILL. DEPT. OF ENVIRONMENTAL SCIENCES AND ENGINEERING.
Measurement of Aquatic Biodegradation Rates by Determining Heterotrophic Uptake of Radiolabeled Pollutants,
W83-00392 5B

NORTH CAROLINA UNIV., CHARLOTTE, DEPT. OF GEOGRAPHY AND EARTH SCIENCES.
A Rapid, Low-Cost Technique for Estimating Peak Flow for Selected Flood Events,
W83-00613 2E

NORTH CAROLINA UNIVERSITY AT WILMINGTON. DEPT. OF BIOLOGY.
A Note on the Relocation of Marsh Debris During a Storm Surge,
W83-00422 2L

NORTH CAROLINIA UNIV. AT CHAPEL HILL. SCHOOL OF PUBLIC HEALTH.
Evaluation of the Tentative Standard Method for Enteric Virus Concentration and Detection,
W83-00629 5A

NORTH DAKOTA UNIV., GRAND FORKS.
Changes in Submersed Macrophytes in Chautauqua Lake, 1937-1975,
W83-00535 2H

NORTH TEXAS STATE UNIV., DENTON. DEPT. OF CHEMISTRY.
Destruction of Pollutants in Water With Ozone in Combination With Ultraviolet Radiation. 2. Natural Trihalomethane Precursors,
W83-00445 5F

Destruction of Pollutants in Water With Ozone in Combination With Ultraviolet Radiation. 1. General Principles and Oxidation of Tetrachloroethylene,
W83-00446 5F

NORTHERN ARIZONA UNIV., FLAGSTAFF. DEPT. OF BIOLOGICAL SCIENCES.
The Effect of Saline Seeps and Restricted Light Upon the Seasonal Dynamics of Phytoplankton Communities Within a Southwestern (USA) Desert Canyon Stream,
W83-00398 2K

O'BRIEN AND GERE ENGINEERS INC., SYRACUSE, NY.
Cost-Effective Program for Combined Sewer Overflow Abatement,
W83-00659 5G

OAK RIDGE NATIONAL LAB., TN.
Determination of Selected Organics in Treated Sludges and Associated Leachates From Coal Conversion Facilities,
W83-00383 5A

Dissolved Humic Materials: Photodegradation, Sediment Effects, and Reactivity with Phosphate and Calcium Carbonate Precipitation,
W83-00397 2H

Continuous Monitoring, Automated Analysis, and Sampling Procedures,
W83-00488 5A

Desalting Seawater and Brackish Waters: 1981 Cost Update,
W83-00642 3A

OKAYAMA UNIV. (JAPAN). DEPT. OF CHEMISTRY.
Solvent Extraction of Molybdophosphate with Cationic Dyes and Spectrophotometric Determination of Micro Amounts of Phosphate in Waters,
W83-00355 5A

ONTARIO MINISTRY OF THE ENVIRONMENT, TORONTO.
Urban Runoff Control Technology,
W83-00416 5D

Evaluation of the Performance of a Combined Sewer Overflow Retention Tank,
W83-00627 5D

ORAL ROBERTS UNIV., TULSA, OK. DEPT. OF NATURAL SCIENCE.
Effects of 2,4-D on Non-Target Species in Kerr Reservoir,
W83-00378 3B

OTAGO UNIV., DUNEDIN (NEW ZEALAND). DEPT. OF CHEMISTRY.
Organic Matter and the Surface Charge of Suspended Particles in Estuarine Waters,
W83-00573 2K

OTTAWA UNIV. (ONTARIO). DEPT. OF BIOLOGY.
Fate of Fenitrothion in Aquatic Microcosms and the Role of Aquatic Plants,
W83-00448 5B

OUTOKUMPU OY, KOKKOLA (FINLAND). KOKKOLA WORKS.
The Annual Flood Regime as a Regulatory Mechanism for Phytoplankton Production in Kainji Lake, Nigeria,
W83-00529 2H

PENNICHUCK WATER WORKS, NASHUA, NH.
Design and Construction of the Pennichuck Water Treatment Plant: The Owner's View,
W83-00502 5F

PENNSYLVANIA STATE UNIV., UNIVERSITY PARK.
The Economics of Municipal Wastewater Reuse,
W83-00465 6B

PERKIN-ELMER CORP., NORWALK, CT.
Determination of Arsenic in Synthetic Fuel Process Waters,
W83-00402 5A

PLYMOUTH POLYTECHNIC (ENGLAND).
The Use of Uric Acid as a Method of Tracing Domestic Sewage Discharges in Riverine, Estuarine and Coastal Water Environments,
W83-00646 5A

PLYMOUTH POLYTECHNIC (ENGLAND). JOHN GRAYMORE CHEMICAL LAB.
Rapid Screening Technique Utilising High-Performance Liquid Chromatography for Assessing Acrylamide Contamination in Effluents,
W83-00381 5A

PRINCE (MALCOLM), INC., BUFFALO, NY.
Decentralizing Water Resource Planning and Management,
W83-00454 6B

PROCTER AND GAMBLE CO., CINCINNATI, OH.
The Effect of Water Hardness on Nitrilotriacetate Removal and Microbial Acclimation in Activated Sludge,
W83-00668 5D

PROCTER AND GAMBLE CO., CINCINNATI, OH. PACKAGED SOAP AND DETERGENT DIV.
Fate and Distribution of a Quaternary Ammonium Surfactant, Octadecyltrimethylammonium Chloride (OTAC), in Wastewater Treatment,
W83-00433 5D

QUEEN'S UNIV., KINGSTON (ONTARIO), DEPT. OF GEOGRAPHY.
Contemporary Sedimentary Environments on Baffin Island, N.W.T., Canada: Glaciomarine Processes in Fiords of Eastern Cumberland Peninsula,
W83-00400 2J

READING UNIV. (ENGLAND).
The Response of a Perch, Perca Fluviatilis L., Population to Eutrophication and Associated Changes in Fish Fauna in a Small Lake,
W83-00678 5C

READING UNIV. (ENGLAND). DEPT. OF ZOOLOGY.
Growth and Recession of Aquatic Macrophytes on a Shaded Section of the River Lambourn, England, From 1971 to 1980,
W83-00520 2I

RENSSELAER POLYTECHNIC INST., TROY, NY. DEPT. OF BIOLOGY.
Ecological Consequences of Long-Term Exposure of Anabaena Variabilis (Cyanophyceae) to Shifts in Environmental Factors,
W83-00391 5C

RHODE ISLAND UNIV., KINGSTON. DEPT. OF MICROBIOLOGY.
Inaccuracy of the Preincubation Modified M-FC Method for Estimating Fecal Coliform Densities in Marine Waters,
W83-00491 5A

RICE (LEONARD) CONSULTING WATER ENGINEERS, INC., DENVER, CO.
Colorado Water Rights - An Engineer's Case Studies,
W83-00675 6E

ROLLINS COLL., WINTER PARK, FL. DEPT. OF BIOLOGY.
Widespread Distribution of Ability to Oxidize Manganese Among Freshwater Bacteria,
W83-00390 5B

SAINT ANDREWS UNIV. (SCOTLAND). DEPT. OF APPLIED MATHEMATICS.
The Drift Velocity of Water Waves,
W83-00515 8B

SCHNEIDER (WALTER) LTD., CHUR (SWITZERLAND).
Abnormal Behaviour of Zeuzier Arch-Dam (Switzerland), III. Geodetic Deformation Measurements,
W83-00364 8A

SCIENCE AND EDUCATION ADMINISTRATION, ST. PAUL, MN.
Effect of Liquid Wastewater Sludge Application on Crop Yield and Water Quality,
W83-00656 5E

SCIENCE AND EDUCATION ADMINISTRATION, TIFTON, GA. SOUTHEAST WATERSHED RESEARCH CENTER.
Nonpoint-Source Pollution Control: A Resource Conservation Perspective,
W83-00665 5G

SCS ENGINEERS, COVINGTON, KY.
Survey of On-Going and Completed Remedial Action Projects,
W83-00637 5G

SEVERN-TRENT WATER AUTHORITY, BIRMINGHAM (ENGLAND). DIRECTORATE OF SCIENTIFIC SERVICES.
Extraction and Analysis of Interstitial Water From Sandstone,
W83-00382 5A

SEVERN-TRENT WATER AUTHORITY (ENGLAND).
The Use of Herbicides for Aquatic Weed Control in Water Supply Catchments,
W83-00496 3B

Mains Infestation Control Using Permethrin,
W83-00498 5F

SINGAPORE UNIV. DEPT. OF CIVIL ENGINEERING.
Development of a Settling Model for Primary Settling Tanks,
W83-00671 5D

SMITHSONIAN INSTITUTION, WASHINGTON, DC. OFFICE OF BIOLOGICAL CONSERVATION.
A Comparative Analysis of the C02 and Water Vapor Responses of Two Spartina Species From Georgia Coastal Marshes,
W83-00421 2I

SOFIA UNIV., SOFIA (BULGARIA). DEPT. OF ANALYTICAL CHEMISTRY.
Extraction-Spectrophotometric Determination of Copper (II) with 4-(2-Pyridylazo) Resorcinol and a Long-Chain Quaternary Ammonium Salt,
W83-00354 5A

SOUTH CAROLINA UNIV., COLUMBIA. DEPT. OF GEOLOGY.
Ra-228, Ra-226, Rn-222, in South Carolina Ground Water: Measurement Techniques and Isotope Relationships,
W83-00625 5A

STANFORD UNIV., CA. PROGRAM IN HUMAN BIOLOGY.
Coastal Zone Development: Mitigation, Marsh Creation, and Decision-Making,
W83-00430 6G

SUISELECTRA CONSULTING ENGINEERS, BASEL (SWITZERLAND).
Abnormal Behaviour of Zeuzier Arch-Dam (Switzerland) V. Examination of Condition and Evaluation of Repair Methods,
W83-00366 8A

SYRACUSE UNIV., NY. DEPT. OF CIVIL ENGINEERING.
The Seasonal Cycle of Inorganic Carbon Species in Cazenovia Lake, New York, 1977,
W83-00532 2H

TECHNICAL UNIV. OF DENMARK., LYNGBY. INST. OF HYDRODYNAMICS AND HYDRAULIC ENGINEERING.
Shape and Dimensions of Stationary Dunes in Rivers,
W83-00451 2J

TECHNICAL UNIV. OF SZCZECIN (POLAND). INST. OF WATER ENGINEERING.
Vertical Circulation in Density-Stratified Reservoir,
W83-00676 2H

TECHNISCHE UNIV., BRUNSWICK (GERMANY, F.R.). LEHRSTUHL FUER PHYSISCHE, GEOGRAPHIE UND LANDSCHAFTSOKOLOGIE.
Isotope Input Into Runoff Systems From Melting Snow Covers,
W83-00374 2C

TECHNISCHE UNIV., MUNICH (GERMANY, F.R.). LEHRSTUHL FUER HYDROCHEMIE UND HYDROGEOLOGIE.
Hydrogeochemical Prospecting of Ore-Deposits, Demonstrated on Some Water Analyses From Peru. (Hydrogeochemische Prospektion Von Erzlagerstatten Dargestellt Anhand Einiger Wasseranalysen Aus Peru),
W83-00674 5B

TENNESSEE UNIV., KNOXVILLE. DEPT. OF AGRICULTURAL ECONOMICS AND RURAL SOCIOLOGY.
The Economic Efficiency of Flood Plain Development,
W83-00545 6F

TENNESSEE VALLEY AUTHORITY, CHATTANOOGA.
Power Industry Wastes,
W83-00657 5G

TOKYO INST. OF TECH. (JAPAN). DEPARTMENT OF ENVIRONMENTAL CHEMISTRY.
Self-Consistent Least-Squares Method of Estimating Chemical Composition of the Sources of Chemical Constituents in Natural Waters,
W83-00353 2K

TORONTO UNIV. (ONTARIO). DEPT. OF ZOOLOGY.
An Index of Littoral Zone Complexity and Its Measurement,
W83-00414 2H

TVARMINNE ZOOLOGICAL STATION (FINLAND).
Carbon, Phosphorus and Nitrogen Budgets of the Littoral Equisetum Belt in an Oligotrophic Lake,
W83-00522 2H

The Influence of Sulphite Mill Effluents on Heterotrophic Activity as Measured by Glucose Assimilation,
W83-00536 5C

UNITED NATIONS EDUCATIONAL, SCIENTIFIC AND CULTURAL ORGANIZATION, COLOMBO (SRI LANKA).
The IUH of General Hydrologic System Model,
W83-00652 2A

UNIVERSITAET DES SAARLANDES, SAARBRUECKEN (GERMANY, F.R.). DEPT. OF MICROBIOLOGY.
Investigation on the Microbiology of the Saar River (Untersuchung Zur Microbiologie Der Saar),
W83-00649 5B

UNIVERSITY OF WALES INST. OF SCIENCE AND TECHNOLOGY, CARDIFF (ENGLAND). DEPT. OF APPLIED BIOLOGY.
A Conductiometric Technique for Measuring the Water Velocity in Salmonid Spawning Beds,
W83-00644 2F

UNIVERSITY OF WEST FLORIDA, PENSACOLA. DEPT. OF BIOLOGY.
Diluent Composition for Use of API 20E in Characterizing Marine and Estuarine Bacteria,
W83-00388 5A

UPPSALA UNIV. (SWEDEN). INST. OF LIMNOLOGY.
Limnological Research Can Improve and Reduce the Cost of Monitoring and Control of Water Quality,
W83-00526 5G

UTAH DEPT. OF HEALTH, SALT LAKE CITY.
Community Health Associated With Arsenic in Drinking Water in Millard County, Utah,
W83-00630 5C

UTILITARIAN UNION LAKE CONSTANCE WATER SUPPLY SUESSENMUEHLE, UEBERLINGEN (GERMANY, F.R.).
Influence of Valence State on the Determination of Antimony, Arsenic, Bismuth, Selenium and Tellurium in Lake Water Using the Hydride AA Technique,
W83-00403 5A

VICTORIA UNIV. OF MANCHESTER (ENGLAND). DEPT. OF GEOGRAPHY.
Meltwater Hydrology and Hydrochemistry in Snow- and Ice-Covered Mountain Catchments,
W83-00377 2C

VICTORIA UNIV. OF MANCHESTER (ENGLAND). POLLUTION RESEARCH UNIT.
The Character and Dispersal of Motorway Run-Off Water,
W83-00461 5B

WASHINGTON UNIV., SEATTLE. DEPT. OF CIVIL ENGINEERING.
Adjudicatory Hearings as Part of the NPDES Hearing Process,
W83-00424 6E

WATER MANAGEMENT IRRIGATION ASSOCIATION, BELTSVILLE, MD.
Irrigation in America-Today and Tomorrow,
W83-00592 3F

WATER PROTECTION ASSOCIATION OF SAVO, KUOPIO (FINLAND).
Convection in Bottom Sediments and its Role in Material Exchange Between Water and Sediments,
W83-00531 5B

WATER RESOURCES COUNCIL PROCESS ENGINEERING, (ENGLAND).
Uprating Sludge Treatment Processes,
W83-00462 5E

WATERLOO UNIV. (ONTARIO). DEPT. OF BIOLOGY.
Hydrobiological Studies of Eastern Lesser Antillean Islands VII. St. Lucia: Behavioural Drift and Other Movements of Freshwater Marsh Molluscs,
W83-00395 5B

WELLFIELD CONSULTING SERVICES, BABORONE (BOTSWANA).
Groundwater Supply Exploration in Semi-Arid Regions for Livestock Extension--A Technical and Economic Appraisal,
W83-00459 6B

WESSEX WATER AUTHORITY (ENGLAND).
A Solution to Screenings Problems by Dewatering and Incineration,
W83-00473 5D

A Comparison of the Carrousel and Pasveer Ditch Activated Sludge Plant,
W83-00476 5D

WESTERN AUSTRALIA DEPT. OF CONSERVATION AND ENVIRONMENT, PERTH.
Phosphorus Export from Coastal Plain Drainage Into the Peel-Harvey Estuarine System of Western Australia,
W83-00408 5B

WILLIAM AND MARY COLL., GLOUCESTER POINT, VA. INST. OF MARINE SCIENCE.
Kepone Distribution in Selected Tissues of Blue Crabs, Callinectes Sapidus, Collected From the James River and Lower Chesapeake Bay,
W83-00436 5B

WISCONSIN UNIV.-MADISON.
Onsite Alternatives for Treatment and Disposal,
W83-00482 5D

WISCONSIN UNIV.-MADISON. DEPT. OF BACTERIOLOGY.
Assessing Biomass and Production of Bacteria in Eutrophic Lake Mendota, Wisconsin,
W83-00384 2H

WISCONSIN UNIV.-MADISON. DEPT. OF BOTANY.
Biology, Metabolism and Functions of Littoral Submersed Weedbeds of Lake Wingra, Wisconsin, USA: A Summary and Review,
W83-00351 2H

WISCONSIN UNIV.-STEVENS POINT. DEPT. OF CHEMISTRY.
Sorption of Zinc by Lake Michigan Sediments--Implications for Zinc Water Quality Criteria Standards,
W83-00643 5B

WREXHAM AND EAST DENBIGHSHIRE WATER CO. (ENGLAND).
The Construction of the Marchwiel Reservoir Using a High Density Polyethylene Lining,
W83-00504 8G

ACCESSION NUMBER INDEX

W83-00351 2H
W83-00352 2D
W83-00353 2K
W83-00354 5A
W83-00355 5A
W83-00356 8A
W83-00357 6A
W83-00358 5D
W83-00359 5D
W83-00360 2C
W83-00361 7B
W83-00362 7C
W83-00363 8A
W83-00364 8A
W83-00365 8A
W83-00366 8A
W83-00367 8A
W83-00368 8A
W83-00369 5D
W83-00370 2C
W83-00371 5C
W83-00372 2H
W83-00373 2D
W83-00374 2C
W83-00375 2C
W83-00376 2C
W83-00377 2C
W83-00378 3B
W83-00379 2A
W83-00380 5A
W83-00381 5A
W83-00382 5A
W83-00383 5A
W83-00384 2H
W83-00385 5B
W83-00386 5B
W83-00387 5B
W83-00388 5A
W83-00389 5A
W83-00390 5B
W83-00391 5C
W83-00392 5B
W83-00393 5C
W83-00394 2H
W83-00395 5B
W83-00396 5G
W83-00397 2H
W83-00398 2K
W83-00399 2H
W83-00400 2J
W83-00401 5A
W83-00402 5A
W83-00403 5A
W83-00404 5A
W83-00405 5A
W83-00406 5A
W83-00407 2L
W83-00408 5B
W83-00409 5C
W83-00410 5C
W83-00411 5A
W83-00412 5A
W83-00413 5D
W83-00414 2H
W83-00415 2G
W83-00416 5D
W83-00417 5D
W83-00418 5C
W83-00419 2L
W83-00420 2L
W83-00421 2I
W83-00422 2L
W83-00423 5F
W83-00424 6E
W83-00425 6E
W83-00426 5A
W83-00427 5D
W83-00428 4A
W83-00429 5A
W83-00430 6G
W83-00431 5B
W83-00432 5A
W83-00433 5D
W83-00434 5B
W83-00435 5B
W83-00436 5B
W83-00437 5B
W83-00438 3A
W83-00439 6E
W83-00440 5D
W83-00441 5D
W83-00442 5D
W83-00443 5B
W83-00444 5B
W83-00445 5F
W83-00446 5F
W83-00447 5F
W83-00448 5B
W83-00449 5B
W83-00450 8I
W83-00451 2J
W83-00452 5B
W83-00453 5A
W83-00454 6B
W83-00455 4A
W83-00456 6A
W83-00457 2E
W83-00458 3F
W83-00459 6B
W83-00460 5B
W83-00461 5B
W83-00462 5E
W83-00463 8B
W83-00464 6E
W83-00465 6B
W83-00466 5F
W83-00467 6B
W83-00468 5E
W83-00469 5F
W83-00470 5F
W83-00471 5D
W83-00472 5A
W83-00473 5D
W83-00474 5D
W83-00475 5D
W83-00476 5D
W83-00477 5C
W83-00478 5B
W83-00479 5B
W83-00480 5D
W83-00481 5D
W83-00482 5D
W83-00483 5E
W83-00484 5D
W83-00485 5D
W83-00486 5D
W83-00487 5F
W83-00488 5A
W83-00489 5D
W83-00490 5D
W83-00491 5A
W83-00492 5B
W83-00493 5G
W83-00494 5F
W83-00495 5B
W83-00496 3B
W83-00497 2F
W83-00498 5F
W83-00499 5D
W83-00500 5D
W83-00501 5F
W83-00502 5F
W83-00503 5G
W83-00504 8G
W83-00505 6G
W83-00506 5F
W83-00507 5B
W83-00508 8A
W83-00509 5C
W83-00510 7B
W83-00511 5B
W83-00512 8B
W83-00513 2C
W83-00514 8B
W83-00515 8B
W83-00516 8B
W83-00517 5A
W83-00518 2H
W83-00519 2L
W83-00520 2I
W83-00521 2H
W83-00522 2H
W83-00523 2H
W83-00524 5C
W83-00525 5C
W83-00526 5G
W83-00527 5G
W83-00528 5G
W83-00529 2H
W83-00530 5C
W83-00531 5B
W83-00532 2H
W83-00533 2H
W83-00534 2H
W83-00535 2H
W83-00536 5C
W83-00537 5C
W83-00538 5C
W83-00539 5C
W83-00540 3F
W83-00541 6D
W83-00542 6D
W83-00543 6C
W83-00544 6E
W83-00545 6F
W83-00546 7C
W83-00547 7C
W83-00548 7C
W83-00549 7C
W83-00550 7C
W83-00551 7B
W83-00552 1A
W83-00553 7C
W83-00554 7C
W83-00555 7C
W83-00556 7C
W83-00557 7C
W83-00558 5B
W83-00559 7C
W83-00560 7C
W83-00561 7C
W83-00562 4A
W83-00563 7C
W83-00564 7C
W83-00565 2F
W83-00566 5G
W83-00567 6E
W83-00568 5B
W83-00569 2H
W83-00570 2L
W83-00571 2H
W83-00572 2K
W83-00573 2K
W83-00574 3C
W83-00575 2H
W83-00576 2H
W83-00577 2L
W83-00578 2H
W83-00579 2H
W83-00580 5A
W83-00581 2H
W83-00582 5C
W83-00583 3A
W83-00584 6E
W83-00585 2D
W83-00586 5D
W83-00587 5D
W83-00588 3F
W83-00589 3F
W83-00590 3F
W83-00591 3F
W83-00592 3F
W83-00593 6G
W83-00594 5C
W83-00595 2H
W83-00596 5C
W83-00597 2H
W83-00598 5C
W83-00599 5B
W83-00600 5B
W83-00601 5B
W83-00602 5B
W83-00603 5C
W83-00604 2H
W83-00605 5C
W83-00606 3C
W83-00607 5G
W83-00608 5E
W83-00609 4D
W83-00610 5G
W83-00611 5G
W83-00612 6B
W83-00613 2E
W83-00614 5E
W83-00615 2J
W83-00616 3F
W83-00617 8I
W83-00618 3F
W83-00619 6E
W83-00620 6E
W83-00621 5D
W83-00622 5D
W83-00623 4B
W83-00624 3F
W83-00625 5A
W83-00626 5B
W83-00627 5D
W83-00628 6A
W83-00629 5A
W83-00630 5C
W83-00631 5D
W83-00632 5A
W83-00633 5F
W83-00634 5D
W83-00635 5B
W83-00636 5E
W83-00637 5G
W83-00638 8A
W83-00639 3C
W83-00640 2H
W83-00641 8G
W83-00642 3A
W83-00643 5B
W83-00644 2F
W83-00645 5B
W83-00646 5A
W83-00647 5E
W83-00648 2H
W83-00649 5B
W83-00650 5B
W83-00651 8E
W83-00652 2A
W83-00653 2E
W83-00654 2A
W83-00655 5F
W83-00656 5E
W83-00657 5G
W83-00658 5A
W83-00659 5G
W83-00660 6F
W83-00661 2H
W83-00662 2H
W83-00663 3B
W83-00664 3B
W83-00665 5G
W83-00666 5G
W83-00667 5D
W83-00668 5D
W83-00669 5C
W83-00670 5D
W83-00671 5D
W83-00672 5D
W83-00673 2L
W83-00674 5B
W83-00675 6E
W83-00676 2H
W83-00677 5D
W83-00678 5C
W83-00679 5E
W83-00680 6D
W83-00681 7C
W83-00682 7C
W83-00683 7C
W83-00684 7B
W83-00685 7C
W83-00686 7C

W83-00687 2A
W83-00688 5B
W83-00689 7C
W83-00690 7C
W83-00691 2F
W83-00692 7B
W83-00693 7C
W83-00694 7C
W83-00695 7C
W83-00696 5A
W83-00697 7C
W83-00698 7C
W83-00699 7C
W83-00700 7C

☆ U S GOVERNMENT PRINTING OFFICE 1983 381-011/8

Subject Fields

1 NATURE OF WATER

2 WATER CYCLE

3 WATER SUPPLY AUGMENTATION AND CONSERVATION

4 WATER QUANTITY MANAGEMENT AND CONTROL

5 WATER QUALITY MANAGEMENT AND PROTECTION

6 WATER RESOURCES PLANNING

7 RESOURCES DATA

8 ENGINEERING WORKS

9 MANPOWER, GRANTS, AND FACILITIES

0 SCIENTIFIC AND TECHNICAL INFORMATION

INDEXES

S SUBJECT INDEX

A AUTHOR INDEX

O ORGANIZATIONAL INDEX

N ACCESSSION NUMBER INDEX

NORTH AMERICAN CONTINENT PRICE SCHEDULE

Customers in Canada, United States, and Mexico please use this price schedule; other addressees, write for Folder PR-360-4.

MICROFICHE			PAPER COPY		
A01	$4.50	E01	T01	$6.50	$125.00
		E02	T02	7.50	140.00
		E03	T03	9.50	240.00
A02	7.00	E04	T04	11.50	320.00
A03	8.50	E05	T05	13.50	400.00
A04	10.00	E06	T06	15.50	465.00
A05	11.50	E07	T07	17.50	530.00
A06	13.00	E08	T08	19.50	595.00
A07	14.50	E09	T09	21.50	660.00
A08	16.00	E10	T10	23.50	725.00
A09	17.50	E11	T11	25.50	790.00
A10	19.00	E12	T12	28.50	855.00
A11	20.50	E13	T13	31.50	920.00
A12	22.00	E14	T14	34.50	985.00
A13	23.50	E15	T15	37.50	1,050.00
A14	25.00	E16	T16	40.50	1,115.00
A15	26.50	E17	T17	43.50	1,180.00
A16	28.00	E18	T18	46.50	1,245.00
A17	29.50	E19	T19	51.50	1,310.00
A18	31.00	E20	T20	61.50	**
A19	32.50	E99	T99	**	
A20	34.00				
A21	35.50	N01	35.00		
A22	37.00	N02	40.00		
A23	38.50				
A24	40.00	*Add $1.50 for each additional 25			
A25	41.50	page increment, or portion thereof.			
A99	*	**Contact NTIS for price quote.			

PRICES EFFECTIVE JANUARY 1, 1983

U.S. DEPARTMENT OF COMMERCE
National Technical Information Service
5285 Port Royal Road
Springfield VA 22161

OFFICIAL BUSINESS

PRINTED MATTER

AN EQUAL OPPORTUNITY EMPLOYER

POSTAGE AND FEES PAID
U S DEPARTMENT OF COMMERCE
COM 211

Special Fourth-Class Rate Book

Doc.
I 1.94/2:
16/3

BOOKSTACKS
DOCUMENTS

PB83-910203

DEPOSITORY
UNIVERSITY OF ILLINOIS
AT

SELECTED WATER RESOURCES ABSTRACTS

VOLUME 16, NUMBER 3
MARCH 1983

W83-00701 -- W83-01050
CODEN: SWRABW

SELECTED WATER RESOURCES ABSTRACTS (SWRA) is produced by the Geological Survey, U.S. Department of the Interior, and published monthly by the National Technical Information Service (NTIS), U.S. Department of Commerce.

SWRA is available to Federal agencies and their contractors or grantees in water resources research upon request, citing contract or grant number and sponsoring agency. Write: Water Resources Division, U.S. Geological Survey, MS 421, Reston, VA 22092, U.S. Department of the Interior, Washington, DC 20240. The **SWRA Journal** is also available on subscription from NTIS, 5285 Port Royal Road, Springfield, VA 22161. Annual subscription rates for the North American Continent are:
Journal only, $100; Journal and Annual Indexes, $125; Indexes only, $50. Other addressees, write for prices.

Some documents abstracted in this journal can be purchased from NTIS. Price codes are given in the entries and a current code-price conversion table is printed on the outside back cover. Other documents are available from originating organizations or authors as indicated in the citation.

SELECTED WATER RESOURCES ABSTRACTS

A monthly publication of the Geological Survey
U.S. Department of the Interior

VOLUME 16, NUMBER 3
MARCH 1983

W83-00701 -- W83-01050

The Secretary of the Interior has determined that the publication of the periodical is necessary in the transaction of the public business required by law of this Department.

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.

PREFACE

Selected Water Resources Abstracts, a monthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. These documents cover water resources as treated in the life, physical, and social sciences and the related engineering and legal aspects of the characteristics, supply condition, conservation, control, use, or management of water resources. Each abstract includes a full bibliographic citation and a set of descriptors which are listed in the **Water Resources Thesaurus.** The abstract entries are classified into 10 fields and 60 groups similar to the water resources research categories established by the Committee on Water Resources Research of the then Federal Council for Science and Technology.

Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientitsts, engineers, and managers as one of several services of the Water Resources Scientific Information Center. The cumulative SWRA file from 1968 and monthly updates are available also in magnetic tape through lease from NTIS.

THE WATER RESOURCES SCIENTIFIC INFORMATION CENTER DOES NOT PROVIDE COPIES OF DOCUMENTS ABSTRACTED IN THIS JOURNAL. Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources.

Comments and suggestions concerning the contents and arrangement of this bulletin are welcome.

Water Resources Scientific
Information Center
U.S. Geological Survey, MS 421
Reston, VA 22092

CONTENTS

SUBJECT FIELDS AND GROUPS

Please use the edge index on the back cover to locate Subject Fields and Indexes.

01 NATURE OF WATER

Includes the following Groups: Properties; Aqueous Solutions and Suspensions.

02 WATER CYCLE

Includes the following Groups: General; Precipitation; Snow, Ice, and Frost; Evaporation and Transpiration; Streamflow and Runoff; Groundwater; Water in Soils; Lakes; Water in Plants; Erosion and Sedimentation; Chemical Processes; Estuaries.

03 WATER SUPPLY AUGMENTATION AND CONSERVATION

Includes the following Groups: Saline Water Conversion; Water Yield Improvement; Use of Water of Impaired Quality; Conservation in Domestic and Municipal Use; Conservation in Industry; Conservation in Agriculture.

04 WATER QUANTITY MANAGEMENT AND CONTROL

Includes the following Groups: Control of Water on the Surface; Groundwater Management; Effects on Water of Man's Nonwater Activities; Watershed Protection.

05 WATER QUALITY MANAGEMENT AND PROTECTION

Includes the following Groups: Identification of Pollutants; Sources of Pollution; Effects of Pollution; Waste Treatment Processes; Ultimate Disposal of Wastes; Water Treatment and Quality Alteration; Water Quality Control.

06 WATER RESOURCES PLANNING

Includes the following Groups: Techniques of Planning; Evaluation Process; Cost Allocation, Cost Sharing, Pricing/Repayment; Water Demand; Water Law and Institutions; Nonstructural Alternatives; Ecologic Impact of Water Development.

07 RESOURCES DATA

Includes the following Groups: Network Design; Data Acquisition; Evaluation, Processing and Publication.

08 ENGINEERING WORKS

Includes the following Groups: Structures; Hydraulics; Hydraulic Machinery; Soil Mechanics; Rock Mechanics and Geology; Concrete; Materials; Rapid Excavation; Fisheries Engineering.

09 MANPOWER, GRANTS, AND FACILITIES

Includes the following Groups: Education—Extramural; Education—In-House; Research Facilities; Grants, Contracts, and Research Act Allotments.

10 SCIENTIFIC AND TECHNICAL INFORMATION

Includes the following Groups: Acquisition and Processing; Reference and Retrieval; Secondary Publication and Distribution; Specialized Information Center Services; Translations; Preparation of Reviews.

SUBJECT INDEX

AUTHOR INDEX

ORGANIZATIONAL INDEX

ACCESSION NUMBER INDEX

SELECTED WATER RESOURCES ABSTRACTS

1. NATURE OF WATER

1A. Properties

ESTIMATION OF THE SCATTERING COEFFICIENT OF NATURAL WATERS USING UNDERWATER IRRADIANCE MEASUREMENTS,
Commonwealth Scientific and Industrial Research Organization, Canberra City (Australia). Div. of Plant Industry.
J. T. O. Kirk.
Australian Journal of Marine and Freshwater Research, Vol 32, No 4, p 533-539, 1981. 2 Fig, 1 Tab, 9 Ref.

Descriptors: Natural waters, *Light penetration, Estimating, *Estimating equations, Mathematical equations, Photosynthesis, Monte Carlo methods, Absorption, *Irradiation.

Certain numerical relationships between the optical properties of natural waters that have arisen out of Monte Carlo simulation of the underwater light field have been used to develop an improved method for calculating the scattering coefficients from in situ irradiance measurements. The method also yields a value for the absorption coefficient. Standard curves are presented from which, given irradiance reflectance (R) at a certain optical depth, the values of the average cosine (U) at the depth and the ratio of the scattering and absorption coefficients (b/a) for the water may be read. The product of U and the vertical attenuation coefficient K for net downward irradiance provides an estimate of a. This, multiplied by b/a, then gives the value for b. When applied to published data for Lake Pend Oreille the method gives a value for b differing by only 5% from that which may be calculated by subtracting the absorption coefficient from the beam attenuation coefficient for that lake. Values for scattering coefficients have been calculated by the new method for five water bodies in the southern tablelands of New South Wales for various dates over a 3 year period. The values of b correlate very closely with nephelometric turbidity, an independent measure of light scattering. The new procedure gives higher values than those obtained by an earlier method, but is considered to be more accurate. (Baker-FRC)
W83-00744

2. WATER CYCLE

2A. General

ON THE HEAT EXCHANGE BETWEEN RIVERS AND ATMOSPHERE,
Norwegian Hydrodynamic Lab., Trondheim. Div. River and Harbour Lab.
O. Stang.
Nordic Hydrology, Vol 13, No 2, p 65-78, 1982. 9 Fig, 1 Tab, 9 Ref.

Descriptors: *Heat exchange, *Water temperature, *Reservoir releases, Rivers, Orkla River, Norway, Air-water interfaces, Environmental effects, Temperature, Air temperature, Model studies.

A simple model for describing the heat exchange between flowing water and the atmosphere has been developed to predict water temperatures in rivers involved in reservoir operation. The model shows a semi-empirical relationship between air temperature and water temperature. The model was applied to the Orkla River in Norway. The heat exchange coefficient calculated for the summer of 1980 was at least 42 W per sq m per degree C, about 3 times the value applied to lakes under similar meteorological conditions. Two parameters affected the heat exchange during the study period: increasing wind speed increased heat exchange and increasing volume of water in the river increased the damping of temperature fluctuations at the air/water interface. Dilution with 17.8C river water of water released at different levels (15.3C at the surface and 9C near the bottom) produced calculated temperatures of 17.1 and 15.3C respectively. At a water velocity of 1 m per sec the river temperatures would be 17.4C from a surface water release and 16.4C from a bottom water release at a point 51 km downstream. (Cassar-FRC)
W83-00752

TIME OF CONCENTRATION DETERMINATION FOR SMALL WATERSHEDS,
Missouri Univ., Columbia. Dept of Agricultural Engineering.
J. M. Gregory.
Transactions of the ASAE, Vol 25, No 3, p 686-688, 694, May/June, 1982. 1 Fig, 2 Tab, 13 Ref.

Descriptors: *Mathematical equations, *Rainfall-runoff relationships, Rainfall, Runoff, Watersheds, Rainfall intensity, Mannings equation, *Small watersheds.

An equation has been developed, starting from Manning's equation, for time of concentration for small watersheds. The equation includes variables of watershed slop, length of watershed, hydraulic roughness, fraction of rainfall that runs off or c factor in the rational method, intensity for 1-hr storm for a given return period, area of the watershed and, slope of the rainfall intensity duration relationship for a given location. Assumptions used to develop this equation appear not to limit its use for most small watersheds. One factor, W/P, was developed from experimental data. Otherwise the equation was developed from a theoretical basis. For small agricultural watersheds W/P appears to decrease as the area of watershed increases. If the relationship found between W/P and area for small watersheds is valid for all watersheds, then the equation derived for time of concentration for small watersheds should be valid for any locations where the rainfall intensity-duration relationship is known. Although the equation appears to be complex, with the use of a calculator it becomes relatively simple. (Baker-FRC)
W83-00871

TIME OF CONCENTRATION AND STORAGE COEFFICIENT VALUES FOR ILLINOIS STREAMS,
Geological Survey, Urbana, IL. Water Resources Div.
J. V. Graf, G. Garklavs, and K. A. Oberg.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-219320, Price codes: A03 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 82-13, March 1982. 35 p, 3 Fig, 4 Tab, 13 Ref.

Descriptors: *Concentration time, *Storage coefficient, *Hydrologic models, *Unit hydrographs, Streams, Flood hydrographs, Watersheds, Floods, Rainfall-runoff relationships, Gaging stations, Sites, Model studies, Computer models, *Illinois, HEC-1.

Values of time of concentration and storage coefficient, two unit hydrograph parameters, are presented for 194 and 120 basins in Illinois. Tabulated values consist of those computed by previous investigators as well as those computed for 98 basins as part of this investigation. These additional values were computed by calibration of the U.S. Army Corps of Engineers Flood Hydrograph Package (HEC-1). The significance of differences in method used by each investigator to compute these unit hydrography parameters was evaluated by statistical comparison of four sets of time of concentration values and three sets of storage coefficient values. Because no difference due to method was identified, it is concluded that all of the values tabulated in this report can be used in any application for which time of concentration and storage coefficient are required. (USGS)
W83-00986

A TECHNIQUE FOR ESTIMATING TIME OF CONCENTRATION AND STORAGE COEFFICIENT VALUES FOR ILLINOIS STREAMS,
Geological Survey, Urbana, IL. Water Resources Div.
J. B. Graf, G. Garklavs, and K. A. Oberg.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-218793, Price codes: A02 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 82-22, March 1982. 10 p, 3 Fig, 2 Tab, 7 Ref.

Descriptors: *Estimating, *Concentration time, *Storage coefficient, *Hydrologic models, Streams, Unit hydrographs, Flood hydrographs, Watersheds, Flood peak, Rainfall-runoff relationships, Model studies, *Illinois.

Values of the unit hydrograph parameters time of concentration (TC) and storage coefficient (R) can be estimated for streams in Illinois by a two-step technique developed from data for 98 gaged basins in the State. The sum of TC and R is related to stream length (L) and main channel slope (S) by the relation (TC + R)e = 35.2L0.39S-0.78. The variable R/(TC + R) is not significantly correlated with drainage area, slope, or length, but does exhibit a regional trend. Regional values of R/(TC + R) are used with the computed values of (TC + R)e to solve for estimated values of time of concentration (TCe) and storage coefficient (Re). The use of the variable R/(TC + R) is thought to account for variations in unit hydrograph parameters caused by physiographic variables such as basin topography, flood-plain development, and basin storage characteristics. (USGS)
W83-00988

2B. Precipitation

TEMPORAL AND SPATIAL VARIATION OF RAINFALL ANOMALIES IN AFRICA SOUTH OF LATITUDE 22 DEG DURING THE PERIOD OF METEOROLOGICAL RECORD,
Canterbury Univ., Christchurch (New Zealand).
P. D. Tyson.
Climatic Change, Vol 2, No 4, p 363-371, 1980. 2 Fig, 53 Ref.

Descriptors: *Rainfall, *Regional analysis, *Africa, *Rainfall distribution, *Climatology, *Variability, Precipitation, Rainfall area, Rainfall intensity, Climatic data, Spatial distribution, Temporal distribution.

The historical regional rainfall changes of the subcontinent of southern Africa below 22 deg latitude were examined to supplement knowledge on the global patterns of rainfall variation. Annual rainfall anomalies for this region show a remarkable degree of organization both temporally and spatially. Since the beginning of the twentieth century eight regularly alternating wet and dry spells of nine to ten years duration have been recorded in relation to a widespread quasi 20-year rainfall oscillation. Prior to the turn of the century, a least three spells occurred. The spatial variation of rainfall over southern Arica for each recorded wet and dry spell is presented. (Geiger-FRC)
W83-00863

THE ESTIMATION OF RAIN FROM SATELLITE-BORNE MICROWAVE RADIOMETERS,
McGill Univ., Montreal (Quebec).
S. Lovejoy, and G. L. Austin.
Quarterly Journal of the Royal Meteorological Society, Vol 106, No 448, p 255-276, April, 1980. 5 Fig, 7 Tab, 53 Ref.

Descriptors: *Rainfall, *Estimating, *Satellite technology, *Remote sensing, Weather satellites, Rain, Weather forecasting, Forecasting, Weather data collections, Radiometry, Microwaves.

The state of knowledge in meteorologic radiometry is reviewed. The accuracy with which the effective temperature of a point on the earth's image may be converted to the rainfall rate is discussed. The question of the limitations on the accuracy of the present radiometer technique due to the limited spatial and temporal resolution of the data is considered. Using the available literature and some GATE radar and thermodynamic data, it was possible to estimate the potential accuracy of a microwave birghtness-temperature to rainfall rate conversion as about equal to 70%. This value depends crucially on the amount of cloud water as a function of rainfall rate and on microphysical

processes, none of which seem to be adequately known for cumulo-nimbi. It is argued that this represents a fundamental limit on passive satellite rainfall estimation ability, primarily due to the tremendous variability in cloud thickness and effective rain-layer heights. This limit seems unlikely to be improved upon by using other channels. Using the Wilheit model for temperature to rainfall rate conversion coupled with GATE Phase III radar data it was possible to estimate the error due to low spatial resolution of the Nimbus 7, 0.81 cm channel FOV size. This amounted to + or - 200% for a single FOV, and the need for empirical bias removal is demonstrated. The impact of low temporal resolution was also studied and found to be on the order of + or - 300% for satellite passes once every 12 hr. The much higher spatial and temporal resulution of the GOES imagery generally results in higher overall accuracy. (Baker-FRC)
W83-00876

A MODEL TO DERIVE PRECIPITATION PATTERNS AND VERTICAL VELOCITIES IN LARGE-SCALE RAIN SYSTEMS,
Commonwealth Scientific and Industrial Research Organization, Sydney (Australia). Div. of Cloud Physics.
B. F. Ryan.
Quarterly Journal of the Royal Meteorological Society, Vol 106, No 447, p 201-212, January, 1980. 5 Fig, 1 Tab, 10 Ref.

Descriptors: *Model studies, *Precipitation, *Prediction, Vertical distribution, *Rainfall, Rain, Storms, Cyclones, Storm water.

A simple model is proposed which enables a prediction to be made of precipitation patterns and vertical velocities from single-station serial ascents. Microphysical processes are parametrized by dividing the liquid water generated by the model into cloud and rain water. The ice phase is not explicitly modelled. Rainfall is predicted reasonably well when the cloud cover is extensive and convection is not dominant. Calculations show that the precipitation developed by the model is not strongly dependent on changes in the microphysical parameterization. The proposed model is in good agreement with observations prior to the arrival of the cold front, but it behaves rather poorly in the convection conditions behind the cold front. The reasons for this behavior are associated with the assumptions inherent in the model, of which the four most important are: the geostrophic assumption implied in the thermal wind relation, the neglect of horizontal advection of cloud and rain water, the assertion that there is either 8/8 cloud or no cloud at all, and the parameterization of the convection. In steady rain the model is relatively insensitive to changes in the microphysical parameters. (Baker-FRC)
W83-00894

STOCHASTIC MODELLING OF MONTHLY RAINFALL,
Indian Inst. of Science, Bangalore. Dept. of Civil Engineering.
R. Narayana Iyengar.
Journal of Hydrology, Vol 57, No 3/4, p 375-387, June, 1982. 5 Fig, 1 Tab, 7 Ref.

Descriptors: *Rainfall, *Time series analysis, *Stochastic process, Model studies, Mathematical models, Hydrologic models, Rivers, *India.

A non-Gaussian monthly hydrological time series can be transformed into a Gaussian one based on the hypothesis that a single sample contains all the statistical aspects of the process. For monthly rainfall time series data the square root transformation and an artificial change in the sign from year to year leads to a Gaussian process. The 24-monthly periodic trends can be easily removed by averaging and standardizing to give a zero mean stationary Gaussian process with unit variance. The model is verified by analyzing monthly rainfall series (34-50 years) of ten differing basins in Karnataka, India. The procedure may also be applied to river discharge, as illustrated by application to two Indian rivers. (Cassar-FRC)
W83-00910

RAINFALL INTERSTATION CORRELATION FUNCTIONS IV. ON THE OCCURRENCE OF ZERO AND LESS-THAN-ZERO RESPONSE,
Instituut voor Culturrtechniek en Waterhuishouding, Wagening (Netherlands).
P. T. Stol.
Journal of Hydrology, Vol 57, No .1/2, p 1-21, May, 1982. 4 Fig, 7 Tab, 60 Ref.

Descriptors: *Networks, *Rainfall, *Correlation coefficient, Model studies, *Storms.

The occurrences of zero and less-than zero coefficients in interstation rainfall correlation are reviewed. A table lists 31 examples of coefficients (lowest, -0.90) in the world literature dating back to 1923. In general, negative correlations occur for elementary quantities (storms, cells) at short distances (<20 km), for daily totals at moderate distances (25-250 km), and for longer durations (week to year) at large distances > 500 km. Conditions under which negative values can occur are analyzed analytically using a very simple storm model. Solutions can be expressed in storm, area, and sampling parameters. Reference is made to other storm models for rectangular, exponential, and triangular storms and to a general method to derive rainfall interstation correlation functions. (Cassar-FRC)
W83-00912

MITIGATING DROUGHT THROUGH WEATHER MODIFICATION: SELECTED INSTITUTIONAL AND METEOROLOGICAL ISSUES IN TEXAS; VOLUME TWO, RADAR ECHO CHARACTERISTICS IN THE EDWARDS PLATEAU - BALCONES ESCARPMENT AREA OF TEXAS,
Texas Advisory Commission on Intergovernmental Relations, Austin.
For primary bibliographic entry see Field 3B.
W83-00915

MITIGATING DROUGHT THROUGH WEATHER MODIFICATION: SELECTED INSTITUTIONAL AND METEOROLOGICAL ISSUES IN TEXAS; VOLUME THREE, PRECIPITATION CLIMATOLOGY FOR THE EDWARDS PLATEAU REGION OF TEXAS,
Texas Adivisory Commission on Intergovernmental Relations, Austin.
For primary bibliographic entry see Field 3B.
W83-00916

MITIGATING DROUGHT THROUGH WEATHER MODIFICATION: SELECTED, INSTITUTIONAL AND METEOROLOGICAL ISSUES IN TEXAS; VOLUME FOUR, AN OBJECTIVE STUDY OF THE UPPER-AIR CONDITIONS RELATING TO PRECIPITATION OVER THE SOUTHEASTERN SECTION OF THE EDWARDS PLATEAU IN TEXAS,
Texas Advisory Commission on Intergovernmental Relations, Austin.
For primary bibliographic entry see Field 3B.
W83-00917

WATER DEFICIENCY IN DHARWAD DISTRICT,
University of Agricultural Sciences, Dharwad (India).
B. P. Ratnam, M. M. Hosmani, and S. N. Joshi.
Annals of Arid Zone, Vol 20, No 4, p 229-234, December, 1981. 1 Fig, 4 Ref.

Descriptors: *Water deficit, *Seasonal variation, *Spatial distribution, Arid lands, Dharwad District, *India, Soil water.

Spatial distribution of water deficiency in the Dharwad District, Karnataka State, India, was studied for three seasons. Rainfall varied from 465 mm in the east to 916 mm in the west. Deficiencies were 25-225 mm in kharif (June-September), 100-225 mm in rabi (October-January), and 400-525 mm in summer (February-May). In all seasons the water deficiency rises in the eastern direction. Maps depict water deficiencies in 25 mm isolines for each season. (Cassar-FRC)
W83-01022

2C. Snow, Ice, and Frost

RECONSTRUCTION OF PAST ICE CONDITIONS IN A HUDSON BAY ESTUARY USING TREE RINGS,
Lamont-Doherty Geological Observatory, Palisades, NY.
G. C. Jacoby, and L. D. Ulan.
Nature (London), Vol 298, No 5875, p 637-639, August 12, 1982. 3 Fig, 1 Tab, 20 Ref.

Descriptors: *Ice, *Climatology, *Tree ring analysis, Estuaries, Freezing, Churchill River estuary, Hudson Bay, Model studies, History.

A record of first complete freezing of the Churchill River Estuary, Hudson Bay, was reconstructed for the years 1680-1977 by tree ring analysis for the purpose of estimating past climatic conditions. Extensive historical ice data back to 1741 was available for calibrating and verifying the reconstructed data. The mean day of first freeze was day 323 in the reconstruction and 317-322 for various historical, calibration, and verification periods. Although other ice parameter data were available, ice breakup was considered too responsive to topographical factors. First ice free day was very unreliable, and first partial freezing was difficult to observe accurately. (Cassar-FRC)
W83-00766

THE ST. LAWRENCE RIVER IN WINTER: POPULATION STRUCTURE, BIOMASS, AND PATTERN OF ITS PRIMARY AND SECONDARY FOOD WEB COMPONENTS,
Cornall Univ., Ithaca, NY. Dept. of Natural Resources.
E. L. Mills, S. B. Smith, and J. L. Forney.
Hydrobiologia, Vol 79, No 1, p 65-75, 1981. 6 Fig, 3 Tab, 29 Ref.

Descriptors: Rivers, *Biomass, *Population dynamics, *St. Lawrence River, Winter, *Seasonal variation, Macroinvertebrates, Molluscs, Phytoplankton, Zooplankton, Algal growth, Copepods, Lake Ontario, Great Lakes.

A research program was initiated in 1978 to obtain information on the biological character of the St. Lawrence River in winter. Community structure and standing crop biomass of phytoplankton, zooplankton, and benthic invertebrates of the International Section of the River were studied under winter ice cover. A total of 64 phytoplankton species representing 47 taxa were identified. Diatoms accounted for over 75% of the species identified. Phytoflagellates were persistent and often abundant through the winter. Bluegreens were rare. Algal biomass was low, ranging between 0.2 and 0.6 g/cu m. Diatoms comprised 40-60% of the algal biomass at offshore sites while the Cryptomonads dominated inshore sites near Lake Ontario. The diversity of zooplankton species was low with only 11 species identified. Macroinvertebrate communities were diverse and species composition varied with depth and distance from Lake Ontario. A wide variety were recovered offshore. Molluscs comprised most of the macroinvertebrate biomass at all sites except one. The dominance of diatoms was typical for large rivers. (Baker-FRC)
W83-00779

AIRCRAFT MEASUREMENTS OF ICING IN SUPERCOOLED AND WATER DROPLET ICE CRYSTAL CLOUDS,
Clermont-Ferrand Univ.-2, Aubiere (France).
For primary bibliographic entry see Field 3B.
W83-00948

FORMATION OF ICE CRYSTALS AND DISSIPATION OF SUPERCOOLED FOG BY ARTIFICIAL NUCLEATION, AND VARIATIONS OF CRYSTAL HABIT AT EARLY GROWTH STAGES,
Cold Regions Research and Engineering Lab., Hanover, NH.
For primary bibliographic entry see Field 3B.
W83-00949

MEASUREMENT OF SNOW WATER STORAGE IN THE LAKE SUPERIOR BASIN USING AERIAL GAMMA-RAY SPECTROMETRY,
National Hydrology Research Inst., Ottawa (Ontario).
For primary bibliographic entry see Field 7B.
W83-00965

CALCULATIONS ON A MODEL FOR THE FUTURE BEHAVIOUR OF GRIESGLETSCHER, WALLIS (MODELLRECHNUNGEN ZUM ZUKUNFTIGEN VERHALTEN DES GRIESGLETSCHERS, WALLIS),
National Aeronautics and Space Administration, Greenbelt, MD. Lab. for Atmospheric Sciences.
R. A. Bindschadler.
Wasser, Energie, Luft, Vol 13, No 4, p 113-116, April 1982. 4 Fig, 11 Ref. English summary.

Descriptors: *Glaciers, *Mathematical models, *Projections, *Dams, *Switzerland, Glacier mass balance, Glacier surges, Ablation, Artificial lakes, Prediction, Climatic data, Glacial drift, Ice breakup, Lake ice, Sliding, Model studies, Gries glacier.

A model to predict the future behavior of the Gries glacier in Switzerland was devised in order to assess the safety of the Gries dam, which is located over 600 m below the tongue of the glacier and 200 m within the moraines deposited by the Gries in 1923. The tongue is presently calving ice chunks into the dammed lake. The model devised was a numerical one developed for tempered valley glaciers. It employs a one-dimensional approximation, resting on finite differences, of a continuity equation integrated over a glacier cross-section. The sliding component of glacier movement was not considered because no reliable method of determining this existed. The omission of this factor means that the model is less reliable with increasing lapse of time. In general the existence of a sliding movement would mean an acceleration of glacier reaction to climate and balance changes. Tests using observations made between 1967 and 1978 revealed that the model results agreed with observed changes in glacier thickness and the condition of the tongue when a linear relationship between calving activity and water depth at the calving front was assumed. If the glacier mass balance were to remain the same, as it did from 1967 to 1978, the model predicted in the next 40 years a continuation of the recent recession of the Gries of almost 200 m, followed by another advance of 150 m lasting several centuries. Even under extreme conditions over a short period the glacier would not advance as far as the dam due to the influence of the lake. However, a continuing change in mass balance of 0.19 m/yr would result in the lake becoming filled with ice almost as far as the dam. A cooling of the climate of 0.3 C over a long period would result in the glacier advancing to the dam, and this is considered very probable. Further observations are being made because of the uncertainty of the time scale of the Gries's reaction to such conditions. (Gish-FRC)
W83-00982

2D. Evaporation and Transpiration

RELATING PLANT CAPACITANCE TO THE WATER RELATIONS OF PINUS CONTORTA,
Colorado State Univ., Fort Collins. Dept. of Forest and Wood Sciences.
S. W. Running.
Forest Ecology and Management, Vol 2, No 4, p 237-252, April, 1980. 7 Fig, 3 Tab, 19 Ref.

Descriptors: *Trees, *Water storage, *Transpiration, Leaves, Water potential, Lodgepole pine, Pine trees.

Water storage in lodgepole pine (Pinus contorta Cougl Ex. Laud) was estimated by calculation and measurement. Calculated water storage in different parts of the tree were: roots, 9%; bole, 73%; branches, 14%; and needles, 4%. Needles had an important role in stomatal response through the control of leaf conductance by leaf water potential. Needle water content and leaf water potential were highly correlated when measurements were taken under low transpiration conditions. Sapwood water content remained fairly constant at 60-70% of saturation throughout the summer. Stem sapwood was important reservoir of water at night. This allowed higher transpiration rates in the morning than if root water directly supplied the leaves. Recharge of the sapwood was not as rapid as depletion. (Cassar-FRC)
W83-00784

UTILITY OF FREQUENCY DISTRIBUTION OF MOISTURE ADEQUACY IN THE SELECTION OF CROPS FOR AREAS WITH MARGINAL RAINFALL,
Indian Agricultural Research Inst. (New Delhi).
For primary bibliographic entry see Field 3F.
W83-00806

DAILY PATTERNS OF APPARENT PHOTOSYNTHESIS AND EVAPOTRANSPIRATION IN A DEVELOPING WINTER WHEAT CROP,
Kansas Agricultural Experiment Station, Manhattan. Evapotranspiration Lab.
R. C. Johnson, R. E. Witters, and A. J. Ciha.
Agronomy Journal, Vol 73, No 3, p 414-418, May-June, 1981. 2 Fig, 1 Tab, 21 Ref.

Descriptors: *Solar radiation, *Water use efficiency, *Photosynthesis, *Evapotranspiration, Temperature effects, *Wheat, *Washington, Leaf area index, Leaves, Growth stages, Semiarid lands.

Temperature and shortwave solar radiation were related to apparent photosynthesis (AP), evapotranspiration (ET), and leaf area index for winter wheat in east central Washington, where high temperature occur during later stages of development. AP and ET were measured in plastic film-covered chambers by calculating the differences between intake and exhaust C02 and water concentrations. On clear days with high solar radiation maximum AP declined from 4.2 to 2.9 g C02 per sq m per hour from the stem extension stage to the watery ripe developmental stage. During the same period maximum daily ET was 440-600 g water per sq m per hour but did not decline as leaf index declined from 2.0 to 1.1. As leaf temperatures approached 25C at midday, AP declined during the anthesis, watery ripe, and milky ripe stages. This was not a result of significant stomatal closure because ET did not always decline at the same time. Temperatures above optimal for AP probably caused this decrease in AP at midday. Likewise, water use efficiency, expressed as AP/ET, was lowest at midday and declined as the crop matured. From heading to antithesis the total daily AP on clear and partly cloudy days had a small range, 30.5-32-4 g C02 per sq m per day, even though leaf area index declined 17%. Water use efficiency was greater on partly cloudy and overcast days than on clear days at a given developmental stage. The water use efficiency of a wheat crop grown under these climatic conditions could be improved by using early maturing cultivars. (Cassar-FRC)
W83-00823

USE OF DETERMINISTIC AND EMPIRICAL MODELS TO PREDICT POTENTIAL EVAPOTRANSPIRATION IN AN ADVECTIVE ENVIRONMENT,
California Univ., Riverside. Dept. of Soil and Environmental Sciences.
P. Shouse, W. A. Jury, and L. H. Stolzy.
Agronomy Journal, Vol 72, No 6, p 994-998, November-December, 1980. 4 Fig, 3 Tab, 9 Ref.

Descriptors: *Evapotranspiration, *Arid lands, *Advection, Model studies, Penman equation, Priestly-Taylor correlation, Solar radiation, Pan evaporation, Evaporation, *California, Water loss, Cowpeas, Soil-water-plant relationships.

Five models for predicitng potential evapotranspiration were compared to hydrologic water balance estimates of water loss from a cowpea crop during the 1976 and 1977 seasons and to each other during 1978. Experiments were conducted in an arid section of California. Models were the Penman combined equation, the solar radiation correlation, the Priestly-Taylor correlation, the advection, the advection modified Priestly-Taylor correlation (Jury and Tanner, 1975), and the pan evaporation correlation. Results from the Penman equation, which did not require local calibration, corresponded most closely to measured values. Pan evaporation was the least reliable indicator of evapotranspiration, whether considered on a weekly or seasonal basis. The Priestly-Taylor correlation was not satisfactory if temperature, wind, and humidity conditions changed from year to year. The Priestly-Taylor modification, requiring a single calibration and no consideration of wind run, was adequate, better than the solar radiation correlation, which needed weekly recalibration. In 1977 seasonal cumulative evapotranspiration values (in mm) were: measured, 313 + or - 8; Penman, 324; solar radiation, 307; pan evaporation, 317; Priestly-Taylor, 311; and Priestly-Taylor modification, 332. In 1976 seasonal cumulative evapotranspiration values (in mm) were: measured, 338 + or - 21; Penman, 330; solar radiation, 324; and pan evaporation, 286. (Cassar-FRC)
W83-00825

DESIGN AND TESTING OF A MICROLYSIMETER FOR WETLAND RICE,
International Rice Research Inst. Manila (Philippines).
V. S. Tomar, and J. C. O'Toole.
Agronomy Journal, Vol 72, No 4, p 689-692, July-August, 1980. 3 Fig, 5 Ref.

Descriptors: *Lysimeters, *Evapotranspiration, *Rice, Transpiration, Evaporation, Wetlands, Measuring instruments, Agriculture, Soil-water-plant relationships.

A simple, sensitive, accurate microlysimeter was developed for use in wetland rice fields. It consists of a polyvinyl chloride cylinder, 50 cm long and 20 cm in diameter, sealed at the lower end, and connected to a water reservoir/manometer through flexible tubing. A constant water level is maintained in the microlysimeter with a Mariotte system, which serves as a reservoir/manometer. Evapotraspiration measurements include total evaporative water loss from the free water surface in the cylinder plus transpiration from the canopy. Transpiration is measured by covering the cylinder to stop evaporation from the free water surface within. After laboratory calibration, lysimeters were compared in the field with 40 x 40 cm tanks. The transpiration per unit land area was similar for both types of units. Small, hourly differences in transpiration and evapotranspiration rates were detectable. Average daily transpirations for 4 rice varieties were 7.65 and 8.55 mm on April 11 and 12, repspectively. Transpiration varied throughout the day, from 0.01 cu cm per sq cm per hour at night to about 0.12 cu cm per sq cm per hour at 2 pm. Evapotranspiration values were 0.01-0.13 cu cm per sq cm per hour at midday. (Cassar-FRC)
W83-00826

WATER LOSS FROM A SHORTGRASS STEPPE,
Colorado State Univ., Fort Collins. Natural Resource Ecology Lab.
W. J. Parton, W. K. Lauenroth, and F. M. Smith.
Agricultural Meteorology, Vol 24, No 2, p 97-109, June, 1981. 9 Fig, 16 Ref.

Descriptors: *Evapotranspiration, *Soil-water-plant relationships, *Water loss, Semiarid lands, Seasonal variation, Diurnal variation, Canopy resistance, Recharge, Precipitation, Water stress, Water demand, *Colorado.

Daily and hourly water losses from a semiarid shortgrass steppe at Pawnee, Colorado, were determined during 1972-1975, using a weighing lysimeter. Weights were recorded at 15 min intervals. Daily potential evapotranspiration (PET) rates and canopy resistance were also evaluated. On a monthly basis water loss was generally equal to water input and considerably lower than the PET rate. The ratio of actual to PET varied from 0.1 in February to 0.25-0.3 during the growing season. Daily water loss data showed that water loss was nearly equal to PET immediately after large pre-

cipitation events had decreased rapidly for 4 days after the event. These large precipitation events, > 15 mm (10% of precipitation events and 50% of total precipitation), contributed most of the soil water recharge. Most of the annual water loss occurred during 2-14 days after large precipitation events. The largest water loss event amounted to 4.8 mm per day. Hourly water loss data showed that the water loss rate was maximum when soil was wet, and it fell below the PET rate as soil dried. Mean PET rates were 5.6 mm per day in the growing season and 3.3 mm per day in the non-growing season. Diurnal patterns for water loss were measured for 5 days during June and July 1972. Very little water loss occurred at night. The daytime pattern followed that of solar radiation, with maximum water loss about noon. When soil was wet the canopy resistance was fairly low (2-5 s per cm) and did not change throughout the day. However, on one day when soil was dry, canopy resistance increased from a minimum of 8 s per cm in the early morning to > 25 s per cm by later afternoon. (Cassar-FRC)
W83-00855

EVAPOTRANSPIRATION STUDIES ON RICE IN RELATION TO WATER USE EFFICIENCY,
Agricultural Research and Education Center, Lake Alfred, FL.
For primary bibliographic entry see Field 3F.
W83-00868

THE SIGNIFICANCE OF SURFACE TEMPERATURE PATTERNS ON THE ENERGY BALANCE OF A SMALL LAKE IN THE CANADIAN SHIELD,
Waterloo Univ. (Ontario). Dept. of Geography.
For primary bibliographic entry see Field 2H.
W83-01029

2E. Streamflow and Runoff

A PROCEDURE TO ESTIMATE CHANGES IN FISH POPULATIONS CAUSED BY CHANGES IN STREAM DISCHARGE,
British Columbia Ministry of Environment, Victoria.
C. Newcombe.
Transactions of the American Fisheries Society, Vol 110, No 3, p 382-390, May, 1981. 3 Fig, 3 Tab, 8 Ref.

Descriptors: *Stream discharge, *Fish populations, Populations, Flow discharge, Flow, Discharge, Fish, Water depth, Rivers.

A simple technique is used to estimate the relationship between fish populations and stream discharge. The method is based on measurements of cross-sectional areas of the stream, water depths, and water velocities over a range of stream discharges. It weights these in accordance with frequency distributions of water depth and water velocity preferred by various life-history phases of coho salmon, chinook salmon, and steel head. Changes in the absolute capacity of the stream to support fish are estimated from records of fish abundance at known discharges that are used to calibrate a scale showing changes in relative capacity. Quantitative estimates of changes in the relative capacity of a stream to support fish as a function of stream discharge determined by this technique are statistically correlated with predictions made by an established qualitative method and by various subjective assessments. (Baker-FRC)
W83-00705

THE PHYSICO-CHEMICAL HYDROLOGY OF A TROPICAL SEASONAL RIVER-UPPER OGUN RIVER,
Ibadan Univ. (Nigeria). Dept. of Zoology.
A. A. Adebisi.
Hydrobiologia, Vol 79, No 2, p 157-165, 1981. 6 Fig, 1 Tab, 16 Ref.

Descriptors: *Seasonal variation, *Intermittent streams, *Physicochemical properties, Diurnal distribution, Hydrology, Tropical regions, Ogun River, Rivers, Water depth, Water temperature, Rainfall, Ponds, Hydrogen ion concentration, Dissolved oxygen, Carbon dioxide, Conductivity, Lotic environment, Lentic environment, Standing waters, Running waters, *Nigeria.

An investigation is reported into the hydrological regimes of the upper course of the Ogun River, which flows only seasonally, and the effect of the seasonality of the river on the physico-chemical properties of the water. Water depth, rainfall and air temperatures were monitored regularly along with various physico-chemical properties of the water between January 1974 and December 1975. A wet season mean monthly rainfall of 9.72 cm occurred from April through October, while a dry season with mean monthly rainfall of 0.56 cm occurred between November and March. The seasonal changes in the rainfall of the drainage area resulted in an alternation of the hydrological regimes of the river. The high water level of the river that arose as a result of the rains made the water flow unidirectionally from July through December. After the rains, the water level receded gradually to a point where by January the river broke up into a chain of pools. In a lotic state, the water's transparency, pH, total alkalinity and conductivity were lower, while its dissolved oxygen and free carbon dioxide concentrations were higher than the corresponding conditions in the residual pools formed when the water was lentic. In this latter form, the observed diurnal surface water temperature fluctuations were greater and diel thermal stratification occurred. It was evident that the water in both phases was well aerated. The diurnal fluctuations in the water temperatures and the relationship between the determined environmental factors were assayed. (Baker-FRC)
W83-00706

ESTIMATION OF MULTIPLE INFLOWS TO A STREAM REACH USING WATER CHEMISTRY DATA,
Science and Education Administration, Tucson, AZ. Southwest Rangeland Watershed Research Center.
D. A. Woolhiser, H. R. Gardner, and S. R. Olsen.
Transactions of the ASAE, Vol 25, No 3, p 616-622, May/June, 1982. 4 Fig, 9 Tab, 6 Ref.

Descriptors: *Chemical analysis, *Estimating, Streams, Water analysis, Stream discharge, Hydrology, Mathematical models, Mathematical studies, *Colorado, *Ionic studies.

A method is presented which can be used to estimate the quantities of inflow from several sources to a stream reach if the chemical characteristics of the inflows are known. The technique requires that the inflow sources be identified and that the concentrations of the principal anions and cations be measured. A quadratic programming algorithm is used to find the inflows that minimize the sum of squared error terms for m ion balance equations. The method is less sensitive to errors in the chemical analyses if the concentration of each ion is divided by the concentration of that ion in the mixture. This is equivalent to minimizing the sum of squared percentage errors. Errors in estimates of a particular inflow are related to the proportion of the total ionic load contributed by that inflow relative to the total ionic load contributed to the reach of stream. If a significant inflow is omitted from the calculation the error is transferred to the inflows that have similar chemical characteristics. As an example, inflows to a reach of stream were calculated using data from a surface-mined area in western Colorado. The procedure appears to be promising as a method of estimating surface and groundwater inflows to a reach of stream from several sources if the required assumptions are met. (Baker-FRC)
W83-00722

RATING CURVES FOR RIVERS WITH OVER-BANK FLOW,
Glasgow Univ. (Scotland). Dept. of Civil Engineering.
D. A. Ervine, and J. I. Baird.
Proceedings of the Institution of Civil Engineers. Part 2: Research and Theory, Vol 73, No 2, p 465-472, June, 1982. 5 Fig, 10 Ref.

Descriptors: *Rivers, Flow, *Channels, *Shear stress, Physical properties, Flood plains, Mannings's equation, Density, Overland flow, Velocity, Streambeds, Water depth, Depth-area-duration analysis, Mathematical studies.

A method of predicting stage/discharge curves for rivers with overbank flow is presented. The discharge in a channel and flood plain system is calculated allowing for the turbulent shear interaction. For a given channel area, flood plain area and depth of overbank flow, the discharge for asymmetric channels and for symmetric channels can be calculated. The method evolved in this paper has been derived from results of idealized straight channels, with smooth boundaries, and the roughness of the flood plain equal to the channel. It is not yet known if the method is applicable to channels where the flood plain roughness is greater than the main channel. (Titus-FRC)
W83-00751

FINITE ELEMENT MODEL TO DESCRIBE OVERLAND FLOW ON AN INFILTRATING WATERSHED,
Purdue Univ., Lafayette, IN. Dept. of Agricultural Engineering.
C. D. Heatwole, V. O. Shanholtz, and B. B. Ross.
Transactions of the ASAE, Vol 25, No 3, p 630-637, May/June, 1982. 11 Fig, 14 Ref.

Descriptors: *Model studies, *Overland flow, Flow, Channel flow, Streamflow, Sinks, Watersheds, Hydrology, Mathematical studies, Storm runoff.

The Finite Element Storm Hydrogrphic Model (FESHM) was modified to account for transmission losses from the overland flow plane. Transmission losses from overland flow were described by the governing continuity equation of surface flow. Several modifications to model concepts were also needed. The flow routing elements were considered the unit response area of the watershed, thus were characterized by a single set of hydrologic (HRU) properties. A modified solution procedure for overland flow routing was developed to circumvent the computational difficiulties in the finite element numerical method caused by discontinuities in the flow strip. An altenate scheme for element discretization was developed which defined elements as predominantly encompassing single HRS's. Potential advantages of this discretization scheme are that it will enhance the predictive ability of the model, while providing a frame work for evaluating land managment practices at the basic unit response area. The model responded predictably in simulations of several watersheds and hypothetical flow strips, mirroring the intuitively expected response of the physical system. (Baker-FRC)
W83-00867

STREAMFLOW ANOMALY PATTERNS IN THE U.S.A. AND SOUTHERN CANADA--1951-1970,
Boston Univ., MA. Dept. of Geography.
P. J. Bartlein.
Journal of Hydrology, Vol 57, No 1/2, p 49-63, May, 1982. 6 Fig, 2 Tab, 23 Ref.

Descriptors: *Climatic zones, *Streamflow, *Weather patterns, *Canada, Principal component analysis, Distribution patterns, Spatial distribution, Temporal distribution, Networks, Droughts, *United States.

The monthly streamflow anomaly patterns in the U.S. and southern Canada (1950-1970) are examined by principal components analysis of data for 102 stream gaging stations, located in a reasonably uniform spacing over the area. The basic anomaly patterns are of large spatial scale and vary slowly through time, reflecting the temporal and spatial scale of controlling climatic anomalies. The prolonged, widespread drought of the 1950's is clearly indicated by a predominance of negative scores of

the first component. The second component shows the tendency for streamflows in the northwest part of the network to vary inversely with streamflows in the southeast part. The third component describes above normal streamflow in the Midwest and Northeast and below normal streamflow in the West, Great Plains, and Southeast. The fourth component shows below normal flows in the upper Midwest and Great Plains and above normal flows in the West and East. About 75% of the total variance of monthly mean streamflow is accounted for by 24 basic anomaly patterns of large spatial scale. The gaging stations were assigned to 18 groups of highly intercorrelated streams, each essential independent of the others. The hydrological regions defined in this study had weak correlation with the frequency used hydrological regions (except for the Appalachian Crest and Continental Divide) and stronger relationships with climatic regions. (Cassar-FRC)
W83-00902

AN APPROACH TO THE STUDY OF TRANSVERSE MIXING IN STREAMS,
Research Inst. for Water Resources Development, Budapest (Hungary).
L. Somlyody.
Journal of Hydraulic Research, Vol 20, No 2, p 203-220, 1982. 11 Fig, 20 Ref.

Descriptors: *Mixing, *Streams, *Model studies, Channels, Turbulence, Dispersion, Austria, Water pollution sources, Mathematical equations, Water resources development.

Transverse mixing has been studied, introducing the concept and the equations of the mass streamline. Dye measurements were performed on several natural and laboratory streams, and the results compared to the calculated concentrations. Several conclusions were drawn from the study. The methods derived appeared well suited to calculating the concentration field and the transverse dispersion coefficient. In the absence of sudden changes in channel geometry and of strong curvatures, there was satisfactory agreement between the calculated and observed values. However, the closeness of agreement depended on the accuracy of the velocity field and the dispersion coefficient, involving also their spatial changes, especially if near bank discharges were considered. The dispersion model can be applied mainly for an overall description of the phenomenon. In the presence of sharp bends, expansions and concentrations, the effect of turbulence on mixing is amplified or diminished by the secondary currents developing. The dispersion coefficient fluctuates accordingly in both directions, potentially assuming even negative values. In such cases the two-dimensional treatment cannot be successfully applied, and only a generalized, three-dimensional approach involving the equations of motion and continuity as well as the turbulence model is likely to be successful. (Baker-FRC)
W83-00909

STEADY FLOW IN ALLUVIAL CHANNELS,
G. Holtorff.
Journal of the Waterway Port Coastal and Ocean Division, Proceedings of the American Society of Civil Engineers, Vol 108, No WW3, p 376-395, August, 1982. 7 Fig, 4 Tab, 5 Ref.

Descriptors: *Alluvial channels, *Channel flow, *Channel morphology, Morphology, Model studies, Flow dynamics, Channels, Flow, *Steady flow.

A theory is developed to predict the formation and deformation of alluvial channels by relating the parameters of the transported substances (fluid and sediment) to those of the channel geometry. The flow-channel system is a feedback system in which the effect (geometry of the channel) and cause (transported substances) are interrelated and interdependent. The parameters of the geometry of the channel and those of the transported substances consist of each of seven variables that can be related to one another by six independent relationships. Possible channel forms are meandering and braided. Meandering channels are formed if the flow dynamics correspond with the channel morphology. Braided channels occur if flow dynamics and channel morphology are incompatible. Alluvial channels are unstable, as the stability criteria for the channel bed and for the channel banks are different. (Baker-FRC)
W83-00940

COMPUTER-SUPPORTED FLOOD PREDICTIONS FOR THE IMPROVEMENT OF FLOOD PROTECTION IN THE DDR (RECHNERGESTUTZTE HOCHWASSERVORHERSAGEN ZUE VERBESSERUNG DES HOCHWASSERSCHUTZES IN DER DDR),
Institut fur Wasserwirtschaft, Berlin (German, D. R.).
A. Becker, and K. Guthlein.
Wasserwirtschaft-Wassertechnik, Vol 31, No 9, p 303-308, September, 1981. 5 Fig, 2 Tab, 21 Ref. (No English Summary).

Descriptors: *Flood forecasting, *Computer models, *Mathematical models, *Elbe river, German Democratic Republic, Flood protection, automation, Data acquisition, Data transmission, Telemetry, flow measuring, Hydraulic models, Hydrological models, Model studies, Prediction, Gages, Remote sensing.

Mathematical models for the prediction of flood waters are discussed, and the application of a computer-supported model for prediction of flow the Eelbe river in the German Democratic Republic during the spring flood of 1981 is described. Hydraulic models, based on hydrodynamic equations and with statements can be applied separately (e.g., dynamic- or diffusion-wave statement), are suitable for rivers and canals with significant backwash effects and for longitudinal transport studies. A large computer is necessary to calculate these models. Conceptual hydrological block-system models, including the single register, lag component, diffusion-analogy and nonlinear step models, are simpler and can be used for rivers without backwash effects and operative flow predictions. These models can be calculated by mini- or microcomputers. The black-box model is used for the same problems as the conceptual model, but requires no consideration of physical conditions. A nonlinear step model was used to predict the flow of the Elbe; it consisted of several parallel linear models, each used to calculate flow in a separate section of the river. The computer calculated water-level predictions for 35 gages on a continuous basis and transmitted the levels at 9 of these by telex to interested users. The model proved generally useful and accurate, though inaccuracies occurred in a section where the river tended to overflow its banks. Other influences on flow not adequately covered by the model were backwash effects where tributaries entered the river and the lower Elbe, weir openings, polder flooding, and a lack of consideration of some tributaries and seepage flows. Research should be done to determine whether these effects could be covered by a hydrodynamic model with separate parameters. The gages served by the model should be included in a central telemonitoring system using the transmission system AQUATRANS. (Gish-FRC)
W83-00976

MEASUREMENT OF TIME OF TRAVEL AND DISPERSION IN STREAMS BY DYE TRACING,
Geological Survey, Reston, VA. Water Resources Div.
For primary bibliographic entry see Field 5B.
W83-00985

TIME OF CONCENTRATION AND STORAGE COEFFICIENT VALUES FOR ILLINOIS STREAMS,
Geological Survey, Urbana, IL. Water Resources Div.
For primary bibliographic entry see Field 2A.
W83-00986

A TECHNIQUE FOR ESTIMATING TIME OF CONCENTRATION AND STORAGE COEFFICIENT VALUES FOR ILLINOIS STREAMS,
Geological Survey, Urbana, IL. Water Resources Div.
For primary bibliographic entry see Field 2A.
W83-00988

A METHOD FOR ESTIMATING THE 7-DAY, 10-YEAR LOW FLOW OF STREAMS IN CONNECTICUT,
Geological Survey, Hartford, CT. Water Resources Div.
M. A. Cervione, Jr., R. L. Melvin, and K. A. Cyr.
Connecticut Water Resources Bulletin No 34, 1982. 17 p, 6 Fig, 1 Tab, 10 Ref.

Descriptors: *Surface water, *Streamflow, *Low flow, *Frequency analysis, Estimating equations, Regression analysis, Water resources development, Planning, Water management, *Connecticut.

The 7-day, 10-year low flow is the statistical low-flow index most commonly used in Connecticut for water-resources planning and management. This low flow can be estimated for any stream in the State that is not affected by man's activities. A regression analysis, relating the observed 7-day, 10-year low flow at 27 stream-gaging stations to the areal distribution of each major aquifer in the upstream drainage area, produced an estimating equation with a standard error of estimate of 1.4 cubic feet per second. Low flows are sustained by the discharge of water from adjacent aquifers. The aquifer having the best water-yielding characteristic is coarse-grained stratified drift. According to the regression equation, a drainage basin with only 0.15 square mile of coarse-grained stratified drift can yield a 7-day, 10-year low flow of 0.1 cubic foot per second. The till-mantled bedrock yields significantly lesser amounts of water to streams at times of low flow. However, a 7-day, 10-year low flow of 0.1 cubic foot per second can be expected from a drainage basin underlain exclusively by till-mantled bedrock if its upstream drainage area is 10 square miles or more. (USGS)
W83-00991

ACCURACY OF FINITE ELEMENT SOLUTIONS OF NAVIER-STOKES EQUATIONS USING A VELOCITY-PRESSURE FORMULATION,
Georgia Inst. of Tech., Atlanta. Center for the Advancement of Computational Mechanics.
C. Bratianu, and S. N. Atluri.
Advances in Water Resources, Vol 5, No 2, p 117-120, June, 1982. 6 Fig, 14 Ref.

Descriptors: *Fluid mechanics, *Fluid flow, Mathematical equations, *Navier-Stokes equations, Velocity, Pressure, *Finite element method, Mathematical studies.

Conditions under which over- or under-constrained discrete domains appear are investigated, along with their influence upon the accuracy of problem solution and practical ways of improving finite element analysis of viscous incompressible fluid flows via a primitive variables approach. Incorporating the continuity equation within the finite element analogue of the Navier-Stokes equations leads unconditionally to over- or under-constrained domains and in consequence to inaccurate solutions. One way of overcoming this situation is to perform a constraint analysis of the discrete domain and choosing that discretization which offers an alpha value close to 0.5. The practical value of this analysis lies in choosing an adequate discretization without performing any numerical experiments, which would imply a great deal of effort and computation time. (Baker-FRC)
W83-01039

CYCLICAL RELATIONSHIPS BETWEEN RIVER DISCHARGE AND CHEMICAL CONCENTRATION DURING FLOOD EVENTS,
Sheffield Univ. (England). Dept. of Civil Structural Engineering.
F. A. Johnson, and J. W. East.
Journal of Hydrology, Vol 57, No 1/2, p 93-106, May, 1982. 10 Fig, 8 Ref.

Descriptors: *Floods, *Discharge hydrographs, *Pollutants, Cyclic relationships, River discharge,

Antecedent moisture, Rainfall, Model studies, Conductance, Storm runoff, Burbage Brook, *England, Fate of pollutants, Mass transfer, Hydrographs.

A series of idealized cyclical relationships between discharge and chemical concentrations of rivers under flood conditions are described. These curves are a smoothed form of a consistently observed pattern resulting from the occurrence of defined extremes of antecedent, rainfall, and recession conditions. The hydrogeological characteristics of a catchment determine the shape of the curve and the rotation, either clockwise or anti-clockwise, with respect to time. Different rainfall intensities in a given catchment produce a family of curves. The idealized cyclical variation of discharge and specific conductance at Burbage Brook, England, did not match the curve produced by any storm event during the study period. However, the starting conditions for an idealized cycle were approached during one storm. It is unlikely that the idealized conditions will be duplicated in England's climate, given the extreme conditions specified. (Cassar-FRC)
W83-01046

2F. Groundwater

THE IMPORTANCE OF GROUNDWATER IN THE TRANSPORTATION OF ALLOCHTHONOUS DISSOLVED ORGANIC MATTER TO THE STREAMS DRAINING A SMALL MOUNTAIN BASIN,
Calgary Univ. (Alberta). Kananaskis Center for Environmental Research.
P. M. Wallis, H. B. N. Hynes, and S. A. Telang.
Hydrobiologia, Vol 79, No 1, p 77-90, 1981. 7 Fig, 2 Tab, 24 Ref.

Descriptors: *Dissolved solids, *Transportation, *Groundwater, Streams, Drainage, Basins, Catchment areas, Chemical composition, Runoff, Precipitation, Rainfall, Rainfall-runoff relationships, Mountains, Humic acids, Fulvic acids, Tannins, Lignins, Springs, Spring water, Groundwater runoff, *Alberta.

The importance of groundwater in the dissolved organic matter (DOM) budget of small upland streams was examined. In particular, the amount of streamflow which can be attributed to groundwater, the organic chemistry of rainwater, streamwater, and groundwater, and the rate of transfer of DOM in groundwater to the streams of a small mountain catchment basin in Alberta were investigated. In the Marmot Basin almost all precipitation either reaches a stream or is evapotranspired. Precipitation must pass through both the unsaturated zone and the groundwater zone on its way to a stream. Groundwater formed the majority of stream discharge, even during spring snowmelt conditions. DOM in the unsaturated zone averaged 21.2 mg/liter and only 5.9 mg/liter in the saturated groundwater zone. Refractory compounds such as humic and fulvic acids account for most of the DOM in groundwater reaching the stream. DOM in snowfall was low, averaging 3.3 mg/liter compared with 7.7 mg/liter in the throughfall. Tannins and lignins were the most important component in throughfall. DOM in surface waters averaged only 2.2 mg/liter, most of which was refractory in nature, and the rate of input to the stream did not appear greatly influenced by precipitation events. The rate of travel of infiltrating precipitation through the unsaturated zone averaged 0.017 m/day. Time required for this water to pass through the groundwater zone depended on the hydraulic properties of the soil as well as length of flow path, but an average of 10 years was indicated for streamwater. About half the DOM in groundwater was lost as it passed into the stream, presumably due to exposure to benthic bacteria as it swept through the sediments. It is unwise to consider springwater as chemically identical to groundwater. (Baker-FRC)
W83-00710

HYDROGEOLOGICAL CONDITIONS IN THE MIDDLE EAST,
Minerex Ltd., Dublin (Ireland).
D. J. Burdon.
Quarterly Journal of Engineering Geology, Vol 15, No 2, p 71-82, 1982. 4 Fig, 26 Ref.

Descriptors: *Connate water, *Wadi, *Geology, *Arid-zone hydrology, Saline water, Aquifers, Geologic formations, Flow, Bedrock, Groundwater, Geomorphology, Arid climates, Deserts, Sedimentary structures, Storm seepage, Evapotranspiration, *Middle East.

Five factors which influence infiltration to aquifers under conditions of low precipitation and high potential evapotranspiration in the Mideast are discussed. The predominance of fossil groundwater is the most striking hydrogeological phenomenon occurring on a regional scale in the Middle East. It is estimated that 65000 cubic kilometers of groundwater are stored in artesian basins. This is a nonrenewable resource. Renewable groundwater resources of the Middle East are of local rather than regional significance. Some originate outside the Middle East as surface flows in the Nile and Tigris-Euphrates and infiltrating into the sediments in and adjacent to the flood plains. Other renewable resources accumulate within the region where high precipitation and mountainous relief are associated. Such areas include the Tertiary fold mountains from the Taurus to the Oman ranges, and the volcanic and basement highlands of Yemen, Asir and Ethiopia. Locally, in areas of lower precipitation, lenses of recent fresh groundwater float on regional more saline groundwater. In some areas subsurface flows toward and through wadi systems are also of importance. (Titus-FRC)
W83-00724

HYDROGEOLOGY OF THE KUFRA AND SIRTE BASINS, EASTERN LIBYA,
Institute of Geological Sciences, London (England). Dept. of Hydrogeology.
E. P. Wright, A. C. Benfield, W. M. Edmunds, and R. Kitching.
Quarterly Journal of Engineering Geology, Vol 15, No 2, p 83-103, 1982. 9 Fig, 5 Tab, 19 Ref.

Descriptors: *Geology, *Aquifers, *Arid climates, *Arid-zone hydrology, *Sedimentary structures, Basins, Sandstones, Artesian basins, Runoff, Saline water, *Libya, Kufra basin, Sirte basin.

Two major sedimentary basins occur in eastern Libya. The uppermost horizons in each - post-Eocene in the Sirte and Cretaceous Nubian in the Kufra basin - constitute regional hydrogeological systems. The deposits of the Sirte basin include mainly fluviatile sands and clays in the south with marine carbonates and sandy carbonates with some evaporites progressively increasing to the north. The Cretaceous sandstone aquifer in the Kufra basin is essentially phreatic and groundwater flow is to the northeast, discharging into the main Nubian artesian basin of Egypt; water quality is fresh. The groundwater on the south of the Sirte basin is fresh but in the north it becomes brackish in the direction of flow. The known groundwater ages range from 3,000 to 5,000 years BP. It is believed that present water levels may be close to equilibrium, with recharge to the aquifer system occurring from several sources including lateral inflow from the Kufra basin, marginal recharge via run-off from the highlands to the west, and direct recharge from precipitation in the north of the basin. (Titus-FRC)
W83-00725

HYDROGEOLOGY OF THE SYRIAN STEPPE AND ADJOINING ARID AREAS,
Arab Center for the Studies of Arid Zones and Dry Lands, Damascus (Syria).
J. Khouri.
Quarterly Journal of Engineering Geology, Vol 15, No 2, p 135-154, 1982. 14 Fig, 2 Tab, 17 Ref.

Descriptors: Geology, *Aquifers, *Arid-zone hydrology, *Uplift pressure, *Geomorphology, Geologic formations, Flow, Bedrock, Groundwater, Arid climates, Deserts, Sedimentary structures, Geologic fractures, Evaporation, Irrigation, *Syria, *Hydrogeology.

Five large sedimentary basins extend between positive structures formed in the Arabian platform, the most important of which is the Rutbah-Ha'il arch with a northwest-southeast trend. Sediments of continental and shallow neritic facies deposited on the crest and flanks of this tectonic arch act as an important permeable medium for regional groundwater flow. Linear systems resulting from tensional forces developed mainly in a northwest-southeast direction seem to control groundwater transmission towards the Euphrates. Flow transmitted eastwards into the Sirhan basin leaks into minor chert aquifers. It is retarded by the thick Upper Cretaceous-Palogene marl sequence and discharges in sabkhas or via springs. Fresh groundwater which occurs in Paleozoic or Mesozoic rocks in the eastern and north-western part of the region leaks upward into shallow carbonate or detrital aquifers. Leakage occurs along fault zones. In the western part of the area fresh groundwater occurs in the basalt aquifer above the thick Upper Cretaceous-Paleogene aquitard. Deep groundwater which may occur below the marl-clay sequence is generally mineralized. Several high permeability zones in the basalt aquifer are related to the spatial distribution of fracture systems and the pre-basalt topography. Hydrochemical and isotopic data indicate that both present day and pluvial rainfall recharge have occurred to various aquifer systems. Current recharge also occurs from wadi runoff in several areas. Hydrosulfurous waters are common in the southern steppe and are of particular significance along the south Palmyrian regional fault zone. (Titus-FRC)
W83-00726

HYDROGEOLOGY OF THE UMM ER RADHUMA AQUIFER, SAUDI ARABIA, WITH REFERENCE TO FOSSIL GRADIENTS,
Ministry of Agriculture and Water, Riyadh (Saudi Arabia).
W. Bakiewicz, D. M. Milne, and M. Noori.
Quarterly Journal of Engineering Geology, Vol 15, No 2, p 105-126, 1982. 7 Tab, 16 Fig, 7 Ref.

Descriptors: Geology, *Aquifers, *Arid-zone hydrology, *Sandstones, Storage, *Mathematical models, Mathematical studies, Connate water, Basins, Geologic formations, Flow, Bedrock, Groundwater, Geomophology, Arid climates, Deserts, Sedimentary structures, Geologic fractures, *Saudi Arabia, Umm Er Radhuma aquifer, *Hydrogeology.

Much of North Africa and the Arabian peninsula, lying in the Saharan climate zone, is underlain by huge tabular sandstone and carbonate aquifers, ranging in age from Cambrian to Tertiary. These are often saturated with water of reasonable quality and form very valuable resources in an area short of water. The origin of the water in such aquifers is the subject of continuing controversy. Some believe the aquifers are fossil remnants of conditions created by a much wetter climatic regime prevalent some thousands of years ago. Others maintain that the gradients reflect a present day system with groundwater discharge in approximate dynamic equilibrium with recharge. Both a generalized analytical approach and a detailed case study of the Umm Er Radhuma aquifer suggest that the occurrence of fossil gradients in the large aquifers of the Mideast and North Africa is unlikely. Present day recharge does occur, albeit erratically. (Titus-FRC)
W83-00727

HYDROGEOLOGY OF THE GREAT NUBIAN SANDSTONE BASIN, EGYPT,
Egyptian Research Inst., Cairo.
A. A. Shata.
Quarterly Journal of Engineering Geology, Vol 15, No 2, p 127-133, 1982, 4 Fig, 3 Tab, 14 Ref.

Descriptors: *Geology, *Aquifers, *Arid-zone hydrology, *Geomorphology, Sandstones, Artesian basins, Karst, Storage, Geologic formations, Flow, Bedrock, Groundwater, Arid climates, Deserts, Sedimentary structures, Geologic fractures, *Egypt, Nubian Sandstone.

In Egypt the strata of major hydeogeological interest are composed of a sandstone complex ranging from Cambrian to Upper Cretaceous in age.

Known as the Nubian Sandstone, this complex has a thickness varying from less than 500 m to over 3000 m and rests directly on Precambrian basement. A number of major structural fault and fold axes traverse the region in a north-easterly direction. Basement features exercise a dominant control on the structural and sedimentological form of the sandstone complex. The Nubian sandstone underlies an extensive area of Egypt and probably constitutes a single hydrogeological system to the West of the Gulf of Suez. To the east on the Sinai peninsula, a second system may exist with some cnnection to the main western system in the north. The western system comprises a multi-layered artesian basin where huge groundwater storage reserves were accumulated during the pluvials of the Quaternary. The carbonate rocks overlying the Nubian sandstone display karst features locally and are recharged by upwards leakage from the underlying major aquifer. (Titus-FRC)
W83-00736

THE THERMAL SPRINGS OF BATH,
Bath Univ. (England). School of Chemistry.
J. N. Andrews, W. G. Burgess, W. M. Edmunds, R. L. F. Kay, and D. J. Lee.
Nature (London), Vol 298, No 5872, p 339-343, July, 1982. 3 Fig, 1 Tab, 23 Ref.

Descriptors: *Thermal water, *Geothermal resources, *Geochemistry, *Heated water, Geothermal studies, Water temperature, Water circulation, Water analysis, Ions, Water resources development, Boreholes, Groundwater, Bath, *United Kingdom.

A geochemical investigation of the Bath thermal springs and their regional setting was performed. Geochemical techniques were used to determine the water's source, the circulation history, the temperature at depth, and the age of the groundwater. The water had a total mineralization of 2150 mg/liter with Ca(+2) and SO4(-2) as the dominant ions. The water is highly radioactive. The water is meteoric in origin, and maximum rock equilibration temperatures of 64 deg C for chalcedony control and 96 deg C for quartz control were calculated. Recharge probably takes place on the Mendips and the Carboniferous Limestone acts as an important storage aquifer. A pumped drawdown of 30 m in a borehole tapping the resource at depth might supply 100 to 110 cu m/hr. (Small-FRC)
W83-00755

LABORATORY MEASUREMENTS OF RESERVOIR ROCK FROM THE GEYSERS GEOTHERMAL FIELD, CALIFORNIA,
Geological Survey, Menlo Park, CA.
For primary bibliographic entry see Field 8E.
W83-00770

A NEW GEOTHERMAL ANOMALY IN NICARAGUA,
Kent State Univ., OH. Dept.of Geology.
Y. Eckstein.
Journal of Hydrology, Vol 56; No 1/2, p 163-174, March, 1982. 7 Fig, 1 Tab, 12 Ref.

Descriptors: *Geothermal studies, *Recharge, *Heat flow, *Nicaragua, *Geohydrology, Groundwater reservoirs, Aquifers, Groundwater recharge.

The large geothermal reservoir in the region of Masaya-Nandaime, Nicaragua, first indicated by a reconnaissance survey in 1978, was explored and characterized. The reservoir, with a temperature greater than 200C, is located at a depth between 2 and 4 km in the Brito Formation, 3400 m thick and predominantly graywacke. The geothermal reservoir, sealed with a silica cap (depth 300-700 m to 2 km), is camouflaged by a thick overlying phreatic aquifer (Las Sierras) that intercepts and redistributes heat from the reservoir. The water quality and temperature in the springs and shallow wells in this region are characteristic of fresh recharge aquifers rather than geothermal formations. The 100C isotherm varies from 2000 m deep near the Lake Nicaragua shore to 600 m deep further from the lake shore. (Cassar-FRC)
W83-00895

ALGERIAN THERMALISM IN ITS GEOSTRUCTURAL SETTING--HOW HYDROGEOLOGY HAS HELPED IN THE ELUCIDATION OF ALGERIA'S DEEP-SEATED STRUCTURE,
Oran Univ. (Algeria). Dept. of Geology.
P. Verdeil.
Journal of Hydrology, Vol 56, No 1/2, p 107-117 March, 1982. 2 Fig, 27 Ref.

Descriptors: *Thermal water, *Geothermal studies, *Geologic fractures, Tectonics, *Algeria, Africa, Geohydrology, Hot springs, Springs, Suflur compounds, Carbon dioxide, Radioactivity, Silica, Geochemistry, Geologic formations, Volcanoes, Minerals, Seismology.

Hydrogeology of North African spring waters helped to elucidate the deep-seated structure of Algeria. Physicochemical characteristics (free carbon dioxide, sulfur compounds, radioactivity, and silica) of Algerian thermal waters did not permit waters to be classified, since waters of different origins often had the same chemical composition. Likewise, connections of thermal and thermomineral discharges with autochthonous and allochthonous formations, volcanism, and mineral deposits were not conslucsive. However, 4 thermal blets, trending southeast (115 degrees), are noticeable along the north African coast. Hot springs are grouped unevenly within these belts and are clustered at the intersection of these belts with fractures running 20 degrees northeast. When the African tectonic plate moves, hydrothermal conduits in the compressed areas close up, producing earthquakes of very great intensity. In the stretched areas, thermal springs appear. Although the seismic foci move about over the faulted system with which they are connected, the hot springs reamin in their original position. The Cherchell-Tenes belt, running across North Africa from Algeria to Egypt, forms the western boundary between the continental crust of the Alboran microplate and the oceanic crust. Several conclusions can be reached from tectonic and thermal data: (1) deep 70 degree north fracturing, (2) deep east-west extension fracturing with thermal uprises, and (3) a geographically defined major fracture which is either the edge of the African plate or a micro-Algero-Tunesian plate. The area of Algeria north of this fault drifts southward and is either a part of the Eurasian plate or a separate micoplate. (Cassar-FRC)
W83-00896

EFFECT OF AN EPHEMERAL STREAM ON THE GROUNDWATER LEVEL AND GROUNDWATER QUALITY IN AN ARID ZONE OF INDIA,
Central Arid Zone Research Inst. Jodhpur (India).
For primary bibliographic entry see Field 4B.
W83-00897

HYDRAULIC PROPERTIES OF A MAJOR ALLUVIAL AQUIFER: AN ISOTROPIC, INHOMOGENEOUS SYSTEM--REPLY,
Northern Technical Servies, Houston, TX.
T. L. Foreman, and J. M. Sharp, Jr.
Journal of Hydrology, Vol 57, No 1/2, p 205-206, May, 1982. 6 Ref.

Descriptors: *Aquifer testing, *Groundwater level, *River stages, Alluvial aquifers, Hydraulic properties, *Missouri Aquifer, Thames Valley, United Kingdom, Isotropy.

The reply to a comment on the titled paper, originally published in the Journal of Hydrology, Volume 53, pages 247-268, 1981, states that recharge from bedrock aquifers is not significant in controlling groundwater levels in the Missouri aquifer. Unlike the Thames, with its high terrace deposits, the river stage in the Misouri aquifer has an influence on the groundwater levels in very distant areas of the flood plain. (Cassar-FRC)
W83-00898

HYDRAULIC PROPERTIES OF A MAJOR ALLUVAL AQUIFER: AN ISOTROPIC, INHOMOGENEOUS SYSTEM--COMMENTS,
Institute of Hydrology, Wallingford (England).
J. C. Davey.
Journal of Hydrology, Vol 57, No 1/2, p 230-204, May, 1982. 1 Ref.

Descriptors: *Aquifer testing, *Groundwater level, *River stages, Alluvial aquifers, Hydraulic properties, *Missouri Afquifer, Thames Valley, United Kingdom, Isotropy.

Comments on the above-titled paper by T. L. Foreman and J. M. Sharp, Jr., Journal of Hydrology, Volume 53, pages 247-268, 1981, on the Missouri alluvial aquifer speculate that the results may be applied to similar basins such as the Thames Valley, United Kingdom, between Oxford and Wallingford. Thames studies, relying on extensive drilling and monitoring, have differed somewhat from the Missouri approach. In the Thames, groundwater levels beyond 300 m from the river are not dominated by river stage but by hydraulic head within higher terrace deposits. (Cassar-FRC)
W83-00899

THE VALUE OF IODIDE AS A PARAMETER IN THE CHEMICAL CHARACTERISATION OF GROUNDWATERS,
Birmingham Univ. (England). Dept. of Geological Sciences.
J. W. Lloyd, K. W. F. Howard, N. R. Pacey, and J. H. Tellam.
Journal of Hydrology, Vol 57, No 3/4, p 247-265, June, 1982. 9 Fig, 4 Tab, 34 Ref.

Descriptors: *Geochemistry, *Iodides, *Saline water, *Groundwater, *Aquifers, Alluvial aquifers, Estuaries, Sedimentary rocks, Leaching, Seawater, Saline water intrusion, Brackish water, Chemical composition, Chalk Aquifer, *England, Sherwood Aquifer, *Qatar, Lima Basin, *Peru.

Iodide is a useful parameter in identifying sources and movement of saline groundwater in aquifers. It is present in minor amounts in many sedimentary rocks and granitic rocks, from which it is readily leached into groundwater. Core studies describe the significance of determining iodide in waters from 6 locations in England, Qatar, and Peru. In the English Chalk aquifer iodide concentrations have been used to characterize brackish and saline groundwaters that have been present for many thousands of years. Type I waters (50 micrograms per liter iodide) are enriched with iodide with respect to seawater because of an exchange of iodide between the Chalk (2-5 ppm iodide) and groundwater. Type II groundwater with lower iodide concentrations are identified as modern saline waters intruding into estuaries. The Sherwood Sandstone aquifer with few faunal remains and low iodine levels has water of two types based on Na/Cl ratios: Type I, present-day seawater intrusion waters, and Type II, older estuary waters which have been reverse ion exchanged with water in estuarine muds in which pore water contains 135 ppm iodide. In the Qatar Tertiary sediments iodide distinguishes the three groundwaters in two aquifers: upper (shallow carbonate and shallow shaly-gypsiferous) and lower (deep carbonate). Saline waters in the upper aquifers are associated with modern saline water intrusion; those in the lower aquifer, with ancient deposits. The Sr(++)/iodide relationship clearly identifies three sources of waters originating from major rock types (alluvium, Jurassic sediments, and granodiorites) in the Lima alluvial aquifer, Peru. The granodiorite waters contain 10-80 micrograms per liter iodide and about 1 mg per liter Sr(++). (Cassar-FRC)
W83-00901

THE LOS AZUFRES, MICHOACAN, MEXICO, GEOTHERMAL FIELD,
Comision Federal de Electricidad, Mexico City.
N. A. Gutierrez, and A. Fabrizio.
Journal of Hydrology, Vol 56, No 1/2, p 137-162, March, 1982. 13 Fig, 9 Ref.

Descriptors: *Geothermal resources, *Exploration, Minerals, Test wells, Volcanoes, Petrology, Los Azufres, *Mexico, Geology.

The Los Azufres, Mexico, geothermal field lies in a complex Plio-Pleistocene succession of rocks representing at least three volcanic cycles. The second

cycle has not been greatly altered, but the first and third cycles have been hydrothermally altered (20-100% of total volume, average 75% to form secondary minerals such as quartz, chlorite, calcite, oxides, clay minerals, epidote, and other minor constituents. The observed patterns suggest the occurrence of two geothermal events, separated in time and space: the first, 5 km from the surface in silicic material and the second, 8-10 km down in a basic source. The detailed knowledge of the mineralogy of this geothermal field, obtained by data from 15 exploratory and production wells, clearly shows which areas are totally unsuitable or favorable for geothermal prospecting. (Cassar-FRC)
W83-00903

A NONLINEAR OPTIMISATION METHOD FOR AQUIFER PARAMETER ESTIMATION.
Roorkee Univ. (India). School of Hydrology.
D. Kashyap, and S. Chandra.
Journal of Hydrology, Vol 57, No 1/2, p 163-173, May, 1982. 1 Fig, 9 Ref.

Descriptors: *Aquifer characteristics, *Water table profiles, *Recharge, Optimization, Numerical analysis, Hydrologic properties, Geohydrology, Groundwater, Rainfall, Pumping, Krushni River, Hindon River, *India, Storage coefficient, Permeability, Transmissivity, Model Studies.

A numerical scheme for quantitative estimation of aquifer parameters is developed. This technique, based on the constrained minimization of the sum of the squares of the residues in the Boussinesq equation, estimates the spatially distributed values for: storage coefficient, orientation of the principal permeability directions, transmissibility values along the major and minor principal permeability directions, rechange coefficient, and groundwater pumpages. The spatial derivatives of the hydraulic head are estimated by the least-squares polynomial approximation, and the temporal derivates are estimated by the forward finite-difference scheme. The scheme is applied to a 340 sq km area between the rivers Krishni and Hindon, India, for which monthly water table data were available for 1972-75 at 21 observation points. (Cassar-FRC)
W83-00905

A LAYERED THERMAL-WATER TWIN FLOW SYSTEM,
Research Inst. for Water Resources Development, Budapest (Hungary).
L. Alfoldi.
Journal of Hydrology, Vol 56, No 1/2, p 99-105, March, 1982. 5 Fig, 1 Ref.

Descriptors: *Thermal water, *Groundwater movement, *Geothermal studies, Hot springs, Infiltration, Budapest, *Hungary, Marl, Karst hydrology, Springs, Flow system, Impervious beds, Geohydrology.

Thermal springs in the region of Budapest, Hungary, originate in the 4000/m thick Triassic-Permian carbonate formation, which is divided by 2 impervious marl series into a karstic and 2 fissured flow path systems. A layered thermal water flow system has formed. The monoclinal attitude of the flow paths forces the water infiltrating into the outcrops to slowly penetrate to deep permeable strata. The flow under the impermeable layer flows upward and in the reverse direction at the end of the marl, producing warm springs from two directions. The water infiltrating down to the impervious marl is lukewarm, 40-60C. The water reaching the layer below the marl is hotter, up to 125C. The two flow systems are connected in several locations, as evidenced by waters of intermediate temperature. (Cassar-FRC)
W83-00906

DETERMINING THE TURNOVER TIME OF GROUNDWATER SYSTEMS WITH THE AID OF ENVIRONMENTAL TRACERS. 1. MODELS AND THEIR APPLICABILITY,
Institute of Nuclear Physics, Kracow (Poland).
P. Maloszewski, and A. Zuber.
Journal of Hydrology, Vol 57, No 3/4, p 207-231, June, 1982. 7 Fig, 1 Tab, 42 Ref.

Descriptors: *Model studies, *Tracers, *Turnover time, Parametric hydrology, Radioisotopes, *Poland, *Groundwater movement, Dispersion, Mixing, Tritium, Carbon radioisotopes, Springs.

Three new lumped parameter models were developed for the interpretation of environmental radioisotope data in groundwater systems. These were the exponential-piston flow model, the linear-piston flow model, and the dispersive model, based on a new solution of the dispersion equation. The new models were compared with several known models using known case studies on Modry Dul, Cheju Island, Rasche Spring, and Grafendorf. Although lumped parameter models have limitations, their use should be attempted in quantitative interpretation of environmental tracers. This is useful especially for karstic or fractured systems where applicability of conventional methods is limited. The dispersion model and exponential-piston flow model were more appropriate to real situations than other known models. Turnover time values were more reliable, and some information on the system's structure was obtained. The two-parameter models gave as good a fit as did multiparameter finite-state mixing cell models, which should be treated as distributed parameter models. Other models tested were the piston flow, exponential, linear, and finite state mixing cell. (Cassar-FRC)
W83-00908

WATER-LEVEL TRENDS, PUMPAGE, AND CHEMICAL QUALITY IN THE CAMBRIAN-ORDOVICIAN AQUIFER IN ILLINOIS, 1971-1980,
Illinois State Water Survey Div., Champaign.
For primary bibliographic entry see Field 6D.
W83-00947

SULFUR ISOTOPIC COMPOSITION AND WATER CHEMISTRY IN WATER FROM THE HIGH PLAINS AQUIFER, OKLAHOMA PANHANDLE AND SOUTHWESTERN KANSAS,
Geological Survey, Denver, CO. Water Resources Div.
N. C. Krothe, and J. W. Oliver.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-204041, Price codes: A03 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 82-12, 1982. 28 p, 4 Fig, 3 Tab, 7 Ref.

Descriptors: *Sulfur, *Isotope studies, *Groundwater, *Groundwater movement, Water pollution sources, Aquifer characteristics, Chemical analysis, Sampling, Dissolved solids, Sulfates, Hydrogen sulfide, *Oklahoma, *Kansas, High Plains, Ogallala Formation, Sulfur isotopes.

The Ogallala Formation comprises the High Plains aquifer in Oklahoma and southwestern Kansas. Regional ground-water flow is from west to east in the Ogallala Formation, and the concentration of dissolved solids in ground water increases in the direction of flow. This increase may be influenced by residence time, but underlying bedrock appears to control ground-water chemistry. The Ogallala Formation is underlain by Mesozoic rocks in the west and Permian rocks in the east. Mean concentration of dissolved solids in ground water from the Mesozoic rocks is 552 milligrams per liter and Permian rocks is 4,720 milligrams per liter. Mean concentration of dissolved solids for water in the Ogallala Formation is 396 milligrams per liter where it overlies Mesozoic rocks and 569 milligrams per liter where it overlies Permian rocks. Del sulfur-34 sulfate values range from a high of +6.9 parts per thousand to a low of -25.1 parts per thousand. Sulfate increases from about 20 milligrams per liter to more than 350 milligrams per liter from west to east. Increasing concentration of dissolved solids, lighter Del sulfur-34 values, and increasing sulfate concentration in the east implies that ground water or hydrogen sulfide from Permian rocks may be moving upward into the Ogallala Formation. (USGS)
W83-00987

GROUNDWATER LEVELS IN NEBRASKA, 1981,
Geological Survey, Lincoln, NE. Water Resources Div.
M. S. Johnson, and D. T. Pederson.
Nebraska Water Survey Paper Number 52, June 1982. 65 p.

Descriptors: *Groundwater, *Wells, *Water level fluctuations, Observation wells, Hydrographs, Well data, Aquifer characteristics, Hydrologic data, *Nebraska.

This report summarizes the 1981 water-level changes in Nebraska on a statewide basis and by major areas where significant changes from estimated predevelopment levels have occurred. It describes the availability of data on water levels, provides information on changes in the water-level measurement program during the year, and summarizes data on the two major causes of water-level changes--precipitation and groundwater use. Because of the large amount of available data, much of the information presented in this report is of a generalized nature. The maps showing areas where water levels have risen or declined are an interpretation of point-value data, and some areas may not be precisely delineated. Changes in water levels are illustrated by hydrographs of 92 continuous-record wells for the period of record. (USGS)
W83-01004

HETEROTROPHIC ACTIVITY AND BIODEGRADATION OF LABILE AND REFRACTORY COMPOUNDS BY GROUNDWATER AND STREAM MICROBIAL POPULATIONS,
Calgary Univ. (Alberta). Dept. of Biology.
T. I. Ladd, R. M. Ventullo, P. M. Wallis, and J. W. Costerton.
Applied and Environmental Microbiology, Vol 44, No 2, p 321-329, August, 1982. 2 Fig, 3 Tab, 46 Ref.

Descriptors: *Bacteria, *Organic matter, *Biodegradation, Streams, Groundwater, Heterotrophic bacteria, Marmot Creek, *Alberta, Soil bacteria, Microorganisms, Mineralization, Degradation.

Bacterial populations in groundwater were greater than in a nearby stream in the subalpine Marmot Basin, Alberta. Bacterial densities increased in groundwater after complete thawing of the soil. The 9 bacteria isolated from the groundwater, which had an average of 2.3 mg per liter dissolved oxygen, were Aeromonas sp., Pseudomonas diminuta, P. fluorescens, P. putida, Flavobacterium sp., Acinetobacter lwoffi, and the Bacilli subtilis, cereus, licheniformis, and megaterium. Groundwater bacteria generally showed a significantly greater utilization of dissolved organic material than did stream bacteria, as measured with glutamic acid, phenylalanine, and glycolic acid substrates. Specific activity indexes suggested greater metabolic activity per bacterium in groundwater. C14-labeled lignocellulose was mineralized at a similar rate by microorganisms in both groundwater and stream, but the labeled lignin fraction was not appreciably degraded (4%) within 960 hours. In contrast, labeled cinnamic acid was 20% mineralized by both groups of bacteria within 500 hours. (Cassar-FRC)
W83-01021

LAPLACE TRANSFORM SOLUTIONS FOR SOLUTE TRANSPORT IN FISSURED AQUIFERS,
Institute of Geological Sciences, Oxfordshire (England).
J. A. Barker.
Advances in Water Resources, Vol 5, No 2, p 98-104, June, 1982. 4 Fig, 12 Ref.

Descriptors: *Solute transport, *Laplace equation, *Fissure water, Aquifers, *Aquifer characteristics, Advection, Dispersion, Adsorption, Mathematical equations, Path of pollutants.

The main processes affecting the migration of a solute in a fissured aquifer are advection and dispersion in the fissures, diffusion into the porous matrix, and adsorption. Solute transport is considered in an idealized fissured aquifer consisting of slabs of saturated rock matrix separated by equally

spaced, planar fissures. The solution of the transport equations is developed as far as Laplace transforms of the solute concentrations in the fissure and matric water. Numerical investigation of the transforms is used to investigate characteristic behavior of the model for a number of special cases. (Baker-FRC)
W83-01027

SEAWATER INTRUSION IN CONTINUOUS COASTAL AQUIFER-AQUITARD SYSTEMS,
Waterloo Univ. (Ontario). Dept. of Earth Sciences.
E. O. Frind.
Advances in Water Resources, Vol 5, No 2, p 89-97, June, 1982. 6 Fig, 17 Ref.

Descriptors: *Seawater, *Confined aquifers, Aquifer characteristics, Aquitards, Geologic formations, Coastal aquifers.

The problem of seawater intrusion in a confined coastal aquifer is investigated. The aquifer is overlain by a leaky aquitard, and both units extend continuously out under the sea. The problem is formulated in terms of the two governing differential equations: the fluid continuity equation, written conveniently in terms of equivalent freshwater head, and the mass continuity equation. Use of linear rectangular finite elements with direct integration and an iterative solution technique lead to an efficient numerical scheme that is capable of handling long simulation periods. The results for a 300 m thick aquifer overlain by a 100 m thick aquitard show that the aquitard has a controlling influence on the salt distribution. A zone of mixing in the aquifer is found to extend for several kilometers in the seaward as well as the landward direction. The time period required by the system to attain a state of dynamic equilibrium after a perturbation is applied may be of the order of centuries. The aquitard causes a downward and seaward displacement of the average salt front. (Baker-FRC)
W83-01028

GALERKIN FINITE ELEMENT METHOD AND THE GROUNDWATER FLOW EQUATION: 1. CONVERGENCE OF THE METHOD,
Orange Free State Univ., Bloemfontein (South Africa).
J. F. Botha, and G. N. Bakkes.
Advances in Water Resources, Vol 5, No 2, p 121-126, June, 1982. 5 Fig, 3 Tab, 18 Ref.

Descriptors: *Finite element method, *Groundwater movement, *Fluid mechanics, Mathematical equations, Mathematical studies, *Galerkin method, Boreholes.

The convergence of the Galerkin finite element method as it applies to a groundwater flow problem containing a borehole is examined with special reference to quadrature effects and the accuracy of the solution. It is demonstrated that there exists an optimal quadrature rule for every choice of piecewise polynomial basis functions. It was also shown that, in a direct application of the method, the accuracy is very nearly independent of the degree of the polynomial basis functions, but is strongly dependent on the distance of the borehole from the boundary if this is small. (Baker-FRC)
W83-01041

ISOTOPIC IDENTIFICATION OF GASES OF A DEEP ORIGIN IN FRENCH THERMOMINERAL WATERS,
Bureau de Recherches Geologiques et Minieres, Orleans (France). Service Geologique National.
F. Batard, J. C. Baubron, B. Bosch, A. Marce, and J. J. Risler.
Journal of Hydrology, Vol 56, No 1/2, p 1-21, March, 1982. 6 Fig, 5 Tab, 35 Ref.

Descriptors: *Geothermal studies, *Thermal water, *Isotope studies, Geochemistry, Geohydrology, Hot springs, Springs, Groundwater movement, Carbon dioxide, Bicarbonates, Mineral springs, Massif Central, Pyrenees, Vosges, *France, Oxygen isotopes, Carbon isotopes, Deuterium, Argon, Nitrogen.

The carbon isotopic compositions of the CO2-bicarbonate system were determined in 50 thermomineral springs in three regions of France: the Massif Central, the eastern Pyrenes, and the southern Vosges mountains. On the basis of isotopic compositions, three sources of primordial or initial carbon have been postulated: exogenous, magmatic endogenous and sedimentary endogenous. Nitrogen isotopes confirmed the atmospheric origin of exogenous carbon, and argon isotopes confirmed the deep origin of springs with magmatic carbon. In the Massif Central, four types of springs with carbon from three sources were identified: sedimentary, magmatic, biogenic, and mixed. Water in springs in the eastern Pyrenees and in the southern Vosges was of meteoric origin. (Cassar-FRC)
W83-01047

WATER TEMPERATURE VARIABILITY AS AN INDICATOR OF SHALLOW-DEPTH GROUNDWATER BEHAVIOUR IN LIMESTONE AREAS IN WEST MALAYSIA,
Saint David's Univ. Coll., Lampeter (Wales). Dept. of Geography.
J. Crowther, and A. F. Pitty.
Journal of Hydrology, Vol 57, No 1/2, p 137-146, May, 1982. 3 Fig, 13 Ref.

Descriptors: *Water temperature, *Variability, *Surface-groundwater relations, Streams, Temperature, Vegetation effects, Air temperature, *Malaysia, Caves, Springs, Deep wells, Deep seepage, Seepage springs, Seepage, Vadose water, Subterranean streams, Underground streams, Cavern flow, Standard deviation.

Temperatures of groundwater and surface streams were determined for a year at 139 sampling points in 3 limestone areas in Malaysia. Sampling was done at the same time each day at 3 or 6-week intervals, depending on location. The standard deviation at each point was a measure of temperature variability. Temperature fluctuations at the 139 locations had an average standard deviation of 0.52 C. Average standard deviations of the individual types of water were 0.05 C in the deepest groundwater borehole, 0.19 C in springs, 0.27 C in 9 cave streams, 0.26 C in 96 cave seepage waters (0.17 C in seepages originating in rock joints, 0.21 C from small stalactites, 0.30 C from large stalactites, and 0.40 C from near-surface air-filled conduits), and 1.4 C (range 0.23-2.28 C) in 31 surface streams. Greatest temperature fluctuations were observed in waters originating close to the surface, in contact with air, in unvegetated streams, and in streams with unvegetated or exposed banks. The standard deviation value appears to be a good indicator of groundwater components in surface streams. (Cassar-FRC)
W83-01048

IN SITU DETERMINATION OF THE HYDROTHERMAL PROPERTIES OF A DEEP FRACTURED MEDIUM BY A SINGLE-WELL TECHNIQUE,
Ecole Nationale Superieure des Mines de Paris, Fontainebleau (France). Centre d'Information Geologique.
J. M. Hosanski, and E. Ledoux.
Journal of Hydrology, Vol 56, No 39-47, March, 1982. 4 Fig, 1 Tab, 1 Ref.

Descriptors: *Geothermal studies, *Heat exchange, *Injection wells, Hydrothermal studies, Test wells, Fissure water, Geologic fissures, Energy sources, Groundwater, Geology, *France, Mayet de Montagne.

A single well technique was successful in the in situ analysis of deep hot rock formations with low permeability. Ice cold water (up to 7.7 C) was injected in volumes up to 4880 liters and to predetermined levels of 12.4-90 m into a well which penetrated water bearing fissures. Pressure (4-59.8 bars) was maintained for 15-195 min, and the temperature of the fluid at the level of the fissure was measured. A model was developed to simulate experiments and to determine the thermal parameters of the rock matrix (thermal conductivity and heat storage capacity) which govern the transfer. The equivalent thermal conductivity of the fissure calculated by the model was 0.008 cal per cm per degree C per sec, compared with an average observed value of 0.0072 cal per cm per degree C per sec. (Cassar-FRC)
W83-01049

INFORMATION ABOUT THE ORIGIN OF THERMOMINERAL WATERS AND GAS BY MEANS OF ENVIRONMENTAL ISOTOPES IN EASTERN AZERBAIJAN, IRAN, AND SOUTHEAST FRANCE,
Paris Univ., Thonon-les-Bains (France). Center for Geodynamic Research.
For primary bibliographic entry see Field 2K.
W83-01050

2G. Water In Soils

A RAPID TECHNIQUE FOR OBTAINING UNIFORM WATER CONTENT DISTRIBUTIONS IN UNSATURATED SOIL COLUMNS,
New Mexico State Univ., Las Cruces. Dept. of Agronomy.
R. Horton, P. J. Wierenga, and D. R. Nielsen.
Soil Science, Vol 133, No 6, p 397-399, June, 1982. 3 Tab, 6 Ref.

Descriptors: *Soil tests, *Microwaves, *Soil columns, Soil water.

Microwave oven exposure of laboratory soil columns facilitated rapid redistribution of water to produce a uniform moisture content. This is necessary for accurate measurement of soil parameters such as thermal conductivity, soil water diffusivity, hydraulic conductivity, and solute diffusion coefficient. Dry fine sand and clay loam and predetermined amounts of water contained in 5 cm diameter, 21 cm long plastic cylinders were subjected to 5-11 heating (4 min) and cooling (2 hours) cycles in a microwave oven over 2-5 days. Determination of volumetric water content in approximately 1 cm core sections showed standard deviations of 0.002 to 0.018 throughout the cores. The major mechanism for water redistribution is vapor phase transport. (Cassar-FRC)
W83-00723

THE THREE-PARAMETER INFILTRATION EQUATION,
Griffith Univ., Nathan (Australia). School of Australian Environmental Studies.
J. Y. Parlange, I. Lisle, R. D. Braddock, and R. E. Smith.
Soil Science, Vol 133, No 6, p 337-341, June, 1982. 1 Fig, 2 Tab, 12 Ref.

Descriptors: *Infiltration, *Soil water, Soil saturation, Sorption, *Conductivity, Equations.

An infiltration equation using a third parameter (alpha), related to soil conductivity, in addition to the usual sorptivity (S) and conductivity at saturation (K1), was developed to interpolate between two commonly-used two-parameter equations. The third parameter had nearly the same value for both soils tested: 0.8501 for clay and 0.8045 for sand. In practice, alpha may be given a value of 0.85 for most soils. This requires determination of only 2 parameters, sorptivity and conductivity. The three-parameter equation proved more accurate than both two-parameter equations and at least as accurate as Haverkamp's (1977) 6-parameter equation. (Cassar-FRC)
W83-00734

C-BAND RADAR FOR DETERMINING SURFACE SOIL MOISTURE,
Centre de Recherches en Physique de l' Environnement, Issy-les Moulineaux (France).
For primary bibliographic entry see Field 7B.
W83-00735

UNRELIABILITIES OF PRESSURE PLATE 1500 KILOPASCAL DATA IN PREDICTING SOIL WATER CONTENTS AT WHICH PLANTS BECOME WILTED IN SOIL-PEAT MIXES,

Department of Agriculture, Summerland (British Columbia). Research Station.
D. S. Stevenson.
Canadian Journal of Soil Science, Vol 62, No 2, p 415-419, May, 1982. 2 Tab, 6 Ref.

Descriptors: *Soil water, *Prediction, Measuring instruments, Estimating, Corn, Sunflowers, *Soil properties, Peat, Sand, Soil types, Moisture availability.

The effects of mixing soil and peat moss on water retention properties were studied and an assessment was made as to how accurately the pressure plate procedure would predict the real water content when plants become wilted for the entire range of mixes from pure soil to pure, relatively inert, peat moss. The 1500-kPa pressure plate extraction technique proved an unreliable predictor of water remaining in soil-peat mixes at the time of wilting. Quantities of water remaining in the mixes when corn and sunflowers wilted increased as the percentage of peat increased, reaching more than 1/3 the volume of the medium in some of the mixes and in pure peat. In the sandy loam mixes the procedure overestimated the March sunflower real wilting percent (RWP), underestimated the May RWP, and up to the 50/50 mix, predicted the RWP for corn reasonably well. In the silt-loam mixes the predictions were slightly better than in the sandy loam mixes but predicted wilting percent (PWP) slightly overestimated the corn RWP and again overestimated the March sunflower RWP. (Baker-FRC)
W83-00782

PREDICTION AND CONTROL OF POROSITY AND WATER RETENTION IN SAND-SOIL MIXTURES FOR DRAINED TURF SITES,
Illinois Univ. at Urbana-Champaign. Dept. of Horticulture.
L. A. Spomer.
Agronomy Journal, Vol 72, No 2, p 361-362, March-April, 1980. 1 Fig, 1 Tab, 8 Ref.

Descriptors: *Porosity, *Drainage systems, *Soil porosity, Golf courses, Perched water table, Model studies, Aeration.

A model was developed to predict the total porosity, water retention porosity, and aeration porosity of sand-soil mixtures in drained turf sites. It applies only to cases where the sand particles are several orders of magnitude larger than the soil particles and where the mixture is underlain with a discrete drainage system 20-40 cm below the surface. Porosities of several compacted soil-sand mixtures, 100% soil, and 100% sand were determined by laboratory testing. Actual porosities were within 3% of the predicted values. This model can be useful in development of recommendations for these mixtures in golf greens without the necessity for field trials. (Cassar-FRC)
W83-00822

A SCREEN-CAGED THERMCOUPLE PSYCHROMETER AND CALIBRATION CHAMBER FOR MEASUREMENTS OF PLANT AND SOIL WATER POTENTIAL,
Intermountain Forest and Range Experiment Station, Ogden, UT.
For primary bibliographic entry see Field 7B.
W83-00827

A LUMPED-PARAMETER MODEL FOR INFILTRATION,
Helsinki Univ. of Technology, Otaniemi (Finland). Systems Theory Lab.
K. Pingoud.
Journal of Hydrology, Vol 57, No 1/2, p 175-185, May, 1982. 6 Fig, 17 Ref.

Descriptors: *Infiltration, *Hydrologic models, *Rainfall-runoff relationships, Soil water, Ponding, Saturation, Model studies, Unsaturated flow, Runoff.

A dynamic lumped parameter model for vertical infiltration is based on a rough spatial discretization of the partial differential equation of water movement in an unsaturated soil. The purpose of the model is to describe infiltration in a catchment with highly variable rainfall rates. It is designed to be used as part of a larger rainfall-runoff model. An approximative algebraic equation connects ponding with the moisture content at the soil surface. The model is flexible in accepting the varying boundary conditions at the surface of the soil. (Cassar-FRC)
W83-00913

SEASONAL PATTERNS OF SOIL WATER RECHARGE AND EXTRACTION ON SEMIDESERT RANGES,
Rocky Mountain Forest and Range Experiment Station, Albuquerque, NM.
D. R. Cable.
Journal of Range Management, Vol. 33, No 1, p 9-15, January, 1980. 3 Fig, 5 Tab, 14 Ref.

Descriptors: *Recharge, *Vegetation effects, *Soil moisture retention, Soil-water-plant relationships, Infiltration, Seasonal variation, Range management, Grasses, Evapotranspiration, Semiarid lands, *Arizona, Shrubs, Desert plants, Evaporation, Storms.

Seasonal patterns of soil water recharge and water extraction by 9 grasses and 3 types of shrubs were studied at 8 locations in the Santa Rita experimental range near Tucson, Arizona, over a 3 year period. The amount and depth of recharge was primarily dependent on the amount of precipitation. Significant amounts of water were added to the soil on 8 occasions (3 in summer, 5 in fall-winter-spring) during the study. Water reached to a 150 cm depth on 1 occasion, to 100 cm twice, to 75 cm twice, and only to 25 cm 3 times. Moisture penetrated deeper and lasted longer in winter than in summer. This was attributed to less evapotranspiration in winter and the lower intensity, smaller droplet size, and lower rainfall velocity of winter storms. Bare soil recharged almost as well as vegetated soil in winter, but summer recharge of bare soil was only 1/3 that of vegetated soil. Well-vegetated soil recharged about as well in summer as in winter. Perennial grasses increased the soil water supply in summer by favoring infiltration, decreasing runoff, and slowing evaporation. Finer subsoils had greater waterholding capacity than sandy soils. Two water depletion periods were observed; (1) spring, during which plants used accumulated cool season moisture, and (2) summer, when plants used current precipitation. Generally all available soil moisture was transpired or evaporated by the end of each depletion period, leaving no carryover moisture. Bare soils lost water more slowly and at a more uniform rate than vegetated soils. Maximum use of precipitation can be obtained in the semidesert ranges by maintaining a diverse ground cover of perennial grasses. (Cassar-FRC)
W83-00932

EVALUATING INFILTRATION FOR BORDER IRRIGATION MODELS,
Science and Education Administration, Phoenix, AZ. Water Conservation Lab.
For primary bibliographic entry see Field 3F.
W83-01026

FREE SURFACE AND SATURATED-UNSATURATED ANALYSES OF BOREHOLE INFILTRATION TESTS ABOVE THE WATER TABLE,
New Mexico Inst. of Mining and Technology, Socorro. Dept. of Geoscience.
D. B. Stephens, and S. P. Neuman.
Advances in Water Resources, Vol 5, No 2, p 111-116, June, 1982. 11 Fig, 12 Ref.

Descriptors: *Boreholes, *Infiltration, *Water table, Free surfaces, Mathematical studies, Model studies, Saturated flow, Saturation, *Unsaturated flow, Soils, Conductivity.

A finite element model capable of solving free surface problems is used to examine the mathematical accuracy of the borehole infiltration formulae. The results show that in the hypothetical case where unsaturated flow does not exist, the approximate formulae are reasonably accurate within a practical range of borehole conditions. To see what happens under conditions closer to those actually encountered in the field the effect of unsaturated flow on borehole infiltration is investigated by means of two different numerical models: a mixed explicit-implicit finite element model and a mixed explicit-implicit integrated finite difference model. The saturated-unsaturated analysis demonstrated that the classical free surface approach provides a distorted picture of the flow pattern in the soil. Contrary to what one would expect on the basis of this theory, only a finite region of the soil in the immediate vicinity of the borehole is saturated, whereas a significant percentage of the flow takes place under unsaturated conditions. As a consequence of disregarding unsaturated flow, the available formulae may underestimate the saturated hydraulic conductivity of fine grained soils by a factor of two, three, or more. The saturated-unsaturated analysis led to an improved design of borehole infiltration tests and a more accurate method for interpreting the results of such tests. The analysis also demonstrated how one can predict the steady state rate of infiltration from data collected during the early transient period of the test. (Baker-FRC)
W83-01038

2H. Lakes

DAPHNIA IN LAKE WASHINGTON,
Washington Univ., Seattle. Dept. of Zoology.
W. T. Edmondson, and A. H. Litt.
Limnology and Oceanography, Vol 27, No 2, p 272-293, 1982. 10 Fig, 1 Tab, 70 Ref.

Descriptors: *Zooplankton, *Predation, *Phytoplankton, *Daphnia, Invertebrates, *Lake Washington, *Washington, Lakes, *Neomysis, Algae, Oscillatoria, Food organisms, Population dynamics, Seasonal variation, Transparency, Physical properties, Crustaceans.

Daphnia suddenly became dominant in Lake Washington in 1976. At this time the mean summer transparency of the lake doubled. The major cause of the increase in Daphnia was a decrease of the predator Neomysis mercidis in the mid-1960's. The input of sewage effluent into the lake had reached a peak of 75,700 cu m per day in 1962-64 and had been totally discontinued by 1968. The 10-year lapse between the decrease in Neomysis and the resurgence in Daphnia was not attributable to decreases in nutrient input from sewage effluent, lack of individuals to serve as an inoculum, changes in planktivorous fish populations, increases in edible food organisms, or decreases in competing zooplankton. The presence of Oscillatoria, a filamentous alga, may have been a delaying factor. Although Daphnia eat Oscillatoria, they reject the filaments accumulated in their feeding systems, thus reducing the efficiency of food intake. Oscillatoria were abundant until 1972, when the population began a progressive decline. By 1976 Oscillatoria absolute abundance and proportion of the total phytoplankton had decreased to very low values. Eight Daphnia species have been observed in the lake, but only D. pulicaria, D. galeata mendotae, and D. thorata are abundant. The population dynamics of the plankton are described in detail. (Cassar-FRC)
W83-00703

THE TROPHIC RESPONSE OF CILIATED PROTOZOANS IN FRESHWATER LAKES,
Florida Univ., Gainesville. Dept. of Environmental Engineering Science.
For primary bibliographic entry see Field 5C.
W83-00704

RECORDS OF A LAKES' LIFE IN TIME: THE SEDIMENTS,
Freshwater Biological Association, Ambleside (England).
For primary bibliographic entry see Field 5C.
W83-00708

PHYTOPLANKTON ECOLOGY OF THE LAKE OF MENTEITH, SCOTLAND,
Sulaimaniyah Univ. (Iraq). Dept. of Biology.
B. K. Maulood, and A. D. Boney.
Hydrobiologia, Vol 79, No 2, p 179-186, 1981. 5 Fig, 2 Tab, 19 Ref.

Descriptors: *Lakes, *Phytoplankton, Nutrients, Nitrogen, Silicates, Carbonates, Algae, Diatoms, Alkalinity, Seasonal variation, Phosphates, Nitrates, Shallow water, Water depth, Hydrogen ion concentration, Water quality, Stratification, Thermal stratification, Oxygen, *Scotland, Lake of Menteth.

The first seasonal ecological study carried out on the phytoplankton of the Lake of Menteith is presented. All measured nutrients reached maximum levels during the winter, with silicate showing particularly high concentrations of up to 85 microgramo-at Si/liter. During the summer period phosphate, nitrate and silicate showed almost complete exhaustion in surface waters. The lake was consistently alkaline, never falling below pH 7, while the alkalinity ranged from 20 to 24 mg CaCO3/liter. In general the nutrient status of the main inflow had a rapid effect on the water quality of the lake. The region of the lake under study showed no thermal stratification at any period of the year, although continuous thermal gradients were recorded in the winter. The continual circulation of the water mass probably prevented oxygen saturation from falling below 77% even following a large phytoplankton bloom and subsequent decomposition. From an examination of net phytoplankton samples the Lake could be described as blue-green or blue-green/diatom in nature. From the quantitative study, large pulses of Melosira, Asterionella and Fragilaria were noted in the spring. The disappearance of the species appears to be related to silicate limitation. The summer growth of Asterionella may be promoted by a nitrogen source other than nitrate and nitrite, both of which were reduced to critical levels. This alternative source may have been contributed by nitrogen-fixing algae in the lake. Three species of Anabaena were noted, each of which produced large populations during the year. (Baker-FRC)
W83-00711

IN SITU GROWTH AND PHOTOSYNTHETIC CHARACTERISTICS OF OSCILLATORIA MOUGEOTII IN THE METALIMNETIC LAYER OF THE SMALL EUTROPHIC LAKE NAKANUMA,
Tsukuba Univ., Ibaraki (Japan). Inst. of Biological Sciences.
Y. Ogawa, and S. Ichimura.
Japanese Journal of Limnology, Vol 42, No 4, p 230-237, October, 1981. 4 Fig, 2 Tab, 14 Ref.

Descriptors: *Algal growth, *Lakes, Eutrophication, Nutrients, Algae, Lake Nakanuma, Limnology, Lake morphology, Photosynthesis, Eutrophic lakes, Stratification, Temperature effects, *Japan.

Photosynthetic characteristics of Oscillatoria mougeotii prevailing in the metalimnion were evaluated using grain density autoradiography. The population growth was analyzed based on production. Water samples were collected in Lake Nakanuma, a small eutrophic lake with a maximum depth of 13.5 meters and a surface area of 1.2 ha. The lake is strongly stratified during summer, and the phytoplankton community, which consists mainly of 0. mougeotii, has prevailed in the metalimnetic layer. When the lake stratified slightly in mid-July, a small population of 0. mougeotii appeared in the bottom layer of the euphotic zone, 6 meters. The thermal stratification was well established by the end of August. A dense population developed in the thermocline, showing a peak distribution at a depth of 6 meters, where the light intensity was 2.4% of that at the surface. Thereafter the increase of population was reduced, and the biomass peak shifted progressively towards the deeper layer within the thermocline until the middle of September. Then 0. mougeotii decreased in cell number, and only a small biomass remained in the hypolimnion by late October. It was concluded that the population development of 0. mougeotii in the metalimnion is mainly due to in situ photosynthetic growth. (Baker-FRC)
W83-00714

DIURNAL CHANGE OF 14C-GLUCOSE UPTAKE BY EPILIMNETIC MICROBES IN LAKE KIZAKI,
Nagoya Univ. (Japan). Water Research Inst.
K. Kato, and M. Sakamoto.
Japanese Journal of Limnology, Vol 42, No 4, p 250-253, October, 1981. 1 Fig, 12 Ref.

Descriptors: *Epilimnion, *Glucose, Metabolism, Lakes, Lake Kizaki, *Japan, Diurnal distribution, Microorganisms, Microbiological studies, Limnology, Mesotrophic lakes, Oligotrophic lakes.

Water samples were taken in July 1980 from the depth of 2.5 meters in Lake Kizaki, a typical mesotrophic lake near the center of Japan, with a maximum depth of 29.5 meters. The photosynthetic carbon assimilation was maximum at the 2.5 meter sampling depth selected. Samples were also taken from 2 and 10 meters; partial circulation was noted from the surface to 9 meters. Diurnal change with a similar pattern of glucose uptake was noted in the three samples. Total glucose uptake was highest in the morning or noon and decreased toward evening, to become 65 to 75% of maximum uptake. Throughout the nocturnal period the total glucose uptake increased with time, and the increasing rate of net assimilation was much greater than that of total uptake. Most of this heterotrophic activity was reasonably ascribed to heterotrophic bacteria in accordance with the size fractionation study on microbial heterotrophic activity made in the same lake. (Baker-FRC)
W83-00715

VERTICAL DISTRIBUTION OF FREE-LIVING AND ATTACHED HETEROTROPHIC BACTERIA IN LAKE KIZAKI,
Nagoya Univ. (Japan). Water Research Inst.
K. Kato, and M. Sakamoto.
Japanese Journal of Limnology, Vol 42, No 3, p 154-159. July, 1981. 4 Fig, 17 Ref.

Descriptors: *Bacteria, *Lakes, *Vertical distribution, Lake Kizaki, *Japan, Organic matter, Natural waters, Hypolimnion, Thermal stratification.

The vertical distribution pattern of heterotrophic bacterial occurrence and its relation to organic matter in a stratified lake were examined as part of a study on bacterial function as indicated by the organic matter metabolism in a lake ecosystem. Lake Kizaki was chosen for study, as it is a mesotrophic lake with a maximum depth of 29.5 meters. A seasonal variation was noted in the lake in the vertical distribution of both heterotrophic bacteria and organic matter. Such variation might be accompanied by a change in the organic matter and bacteria relationship. Water sampling was carried out at the center of the lake during the summer stratification period of 1978. Based on the vertical profile of water temperature, the hypolimnion at more than 10 meters depth can be clearly separated from the upper layer throughout the period of observation. The highest densities of total heterotrophic bacteria in the epilimnion appeared at the surface or just above the thermocline. The minimum number of bacteria was found at the depth of 15 to 20 meters. The number increased in the deeper layer, especially above the mud surface. This may have been due to a water/mud interaction or a disturbance of the mud at the sampling time. In the epilimnion, the mean value of the ratio of the number of free-living bacteria to that of total heterotrophic bacteria was 0.56 and that of attached bacteria was 0.21. In the hypolimnion, where abundant attached bacteria were frequently encountered except in November, the ratio of attached bacteria was 0.34, whereas that of free-living bacteria was 0.20. (Baker-FRC)
W83-00718

STUDIES ON THE DECOMPOSITIVE PROCESSES OF PHYTOPLANKTONIC ORGANIC MATTER,
Nagoya Univ. (Japan). Water Research Inst.
K. Matsunaga.
Japanese Journal of Limnology, Vol 42, No 4, p 220-229, October, 1981. 10 Fig, 1 Tab, 25 Ref.

Descriptors: *Phytoplankton, *Decomposing organic matter, *Chemical reactions, *Kinetics, Organic matter, Detritus, Decomposition, Nitrogen, Phosphorus, Ammonium, Phosphates, Plankton, Nutrients, Lakes, Limnology, *Japan, Lake Kizaki.

A kinetic analysis of the decomposition of phytoplanktonic organic compounds with a concomitant depletion of oxygen and regeneration of inorganic nutrients including nitrogen gas was undertaken. Water samples were taken from the surface layer of Lake Kizaki in Nagano Prefecture, Japan. Phytoplanktonic organic materials were degraded biologically with consumption of oxygen, production of carbon dioxide and regeneration of inorganic nutrients. The atomic ratio of these elements was estimated, although an initial lag-phase was noted for the change in concentrations of ammonium nitrogen as well as phosphate phosphorus. The kinetic considerations indicated that the mechanism of the decomposition of phytoplanktonic organic materials depends on the quality of organic constituents used as a substrate for the biological utilization. The decompositive process consisted of two reaction steps, a rapid step during the first two weeks and a slow one occurring thereafter. Each of the reactions was a first order reaction as reported by other workers. The reaction rate constants of each of the organic constituents were determined in both steps. (Baker-FRC)
W83-00720

THE DISTRIBUTION OF UREA IN LAKE YUNOKO,
Tokyo Metropolitan Univ. (Japan). Dept. of Chemistry.
For primary bibliographic entry see Field 5B.
W83-00721

A STUDY OF THE BENTHIC COMMUNITIES OF TWENTY LAKES IN THE SOUTH ISLAND, NEW ZEALAND,
Canterbury Univ., Christchurch (New Zealand). Dept. of Zoology.
B. V. Timms.
Freshwater Biology, Vol 12, No 2, p 123-138, April, 1982. 4 Fig, 3 Tab, 35 Ref.

Descriptors: *Benthos, *Lakes, *New Zealand, Benthic environment, Benthic fauna, Benthic flora, Aquatic life, Aquatic plants, Flora, Fauna.

In late winter-spring the benthos of a heterogeneous series of lakes was sampled to determine species composition, community structure and standing crops. Nearly 50 species were found, with an average of only 12.4 per lake. Thus there was limited species variation between most of the South Island lakes studied. Moreover, the dominants and most subdominants in each lake typically belong to a small core of species including Limnodrilus hoffmeisteri, Potamopyrgus antipodarum, Chrironomus spp. and Macropelopia spp. A number of groups typical of the benthos in northern hemisphere lakes, and even of Australian lakes, are apparently absent or very poorly represented in New Zealand lakes. Most notable is the absence of the Chaoborinae. Consequent on low species richness and broad niches, there is little or no relationship between species composition and lake trophic status. Chironomids were of little use as indicators of lake production. There was not even a close relationship betwen benthic standing crops and lake trophic status as determined on general limnological characteristics, especially water chemistry and plankton. The relatively low number of benthic species per lake implies that niches tend to be broad, and species composition and dominance is similar in a majority of the lakes sampled, irrespective of their trophic status. The influence of factors such as mean depth, allochthonous organic matter inputs and siltation tends to obscure relations between trophic status and standing crop. Thus, it is not practical to type New Zealand lakes by the characteristics of their benthos. (Baker-FRC)
W83-00737

NUTRIENTS AND PHYTOPLANKTON IN THREE SHALLOW, FRESH-WATER LAKES OF DIFFERENT TROPHIC STATUS IN WESTERN AUSTRALIA,
Western Australia Univ., Nedlands. Dept. of Botany.
For primary bibliographic entry see Field 5C.
W83-00739

INVERTEBRATE FAUNA AND ECOLOGY OF TEMPORARY POOLS ON GRANITE OUTCROPS IN SOUTHERN WESTERN AUSTRALIA,
Monash Univ., Clayton (Australia). Dept. of Zoology.
I. A. E. Bayly.
Australian Journal of Marine and Freshwater Research, Vol 33, No 3, p 599-606, 1982. 6 Fig, 3 Tab, 13 Ref.

Descriptors: *Invertebrates, *Ephemeral lakes, *Australia, Benthic fauna, Granites, Species distribution.

The water quality and invertebrates of 19 transient pools, located on 9 granite outcrops in Western Australia, were documented. Pool depths varied from 2.5 to 150 cm, conductivity from 29 to 500 microS per cm, pH from 3.7 to 6.4, and water temperature in daylight from 10.7 to 17.2C. Animals living in these pools must be able to survive desiccation and high temperatures in summer and low dissolved solids in the wet season. Thirty-five invertebrate taxa were identified. Neothrix animata was the most common cladoderan. Copepods occurred only in two deep pools and one shallow pool. Many animals, including orbatids (beetle mites), lived in association with the black organic detritus at the pool bottom. (Cassar-FRC)
W83-00740

LIMNOLOGY OF PERCHED LAKE, SOUTHWEST TASMANIA,
Tasmania Univ., Hobart (Australia). Dept. of Botany.
R. D. King, and P. A. Tyler.
Australian Journal of Marine and Freshwater Research, Vol 32, No 4, p 501-515, 1981. 7 Fig, 2 Tab, 12 Ref.

Descriptors: *Lakes, *Limnology, *Productivity, Saline lakes, Tasmania, *Australia, Perched Lake, Algae, Plankton, Chrysophytes, Chlorophytes, Dinoflagellates, Temperature effects.

Perched Lake is a warm monomictic or cheimomictic lake in Tasmania, Australia. Anomalous hypolimnetic cooling, observed in 2 years, cannot be explained, but inflow of cold artesian water is a possibility. Probably because of its topographic protection, Perched Lake remains stratified for longer, yet stratifies and turns over earlier in the year, than the deeper Risdon Brook Reservoir, at sea level. Thermal stratification of Perched Lake has predictable effects upon dissolved oxygen. Concentrations in the hypolimnion fall only late in the stratification period and only to 20% of saturation value, indicating low areal production rates in the epilimnion. The water chemistry of the lake is similar in ionic character to that of seawater. The absorbance, color and vertical attenuation coefficients of the lake indicate only moderate amounts of gilvin, sufficient nonetheless to restrict light penetration considerably and to specify a blue-deficient spectrum. The low gilvin values are probably the result of a limited catchment area, so that inflowing waters have short contact time with forest soils. The flora is dominated by Dinobryon, Mallomonas and Peridinium spp. The plankton is dominated by chrysophytes and chlorophytes, with no well-defined seasonal changes of biomass or species composition. An unusual dinoflagellate with marine affinities, probably Phalacroma sp., occurs in the lake. (Baker-FRC)
W83-00742

NATURE AND HYDROCARBON CONTENT OF BLOOMS OF THE ALGA BOTRYOCOCCUS BRAUNII OCCURRING IN AUSTRALIAN FRESHWATER LAKES,
Materials Research Labs., Ascot Vale (Australia).
L. V. Wake, and L. W. Hillen.
Australian Journal of Marine and Freshwater Research, Vol 32, No 3, p 353-367, 1981. 3 Fig, 5 Tab, 18 Ref.

Descriptors: Natural waters, *Eutrophication, *Algae, *Fuel, *Hydrocarbons, Chemical analysis, *Australia, Lakes, *Botryococcus braunii, Chemical composition, Aquaculture, Botryococcene, Coorongite.

The hydrocarbon content and composition of the algal cells of Botryococcus braunii occurring in Australian freshwater lakes and reservoirs were examined as part of a preliminary assessment of this plant as a liquid-hydrocarbon-producing energy crop. Under Australian conditions, blooms of B. braunii were found to have hydrocarbon oil contents between 27 and 40% of the dry mass. The highest oil content was noted in a red bloom and the lowest in a green bloom of the organism. A number of branched-chain hydrocarbons of the general formula CnH(2n-10) where n equals 30, 34, 35, 36 and 37, have been found in both red and green algal blooms. Twelve of these hydrocarbons are novel to this study, and analysis by gas chromatography-mass spectrometry indicates that they are closely related to or isomeric with botryococcene. Straight-chain hydrocarbons were present only in the green stage of the organism. Evidence for the simultaneous occurrence of branched- and linear-chain hydrocarbons in the same plant is inconclusive, as blooms which revealed both types of hydrocarbons were known to contain both stages of the alga. The chemical parameters measured, both of the cell material and of the waters in which they grow, have thus far failed to explain why conditions are sometimes more favorable to the formation of B. braunii blooms than at other times. B. braunii has been noted to form shoreline deposits which undergo a change in pigmentation during desiccation to produce a black rubbery material resembling Coorongite. (Baker-FRC)
W83-00743

PATHWAY AND DISTRIBUTION OF TRACE ELEMENTS IN LAKE VANDA, ANTARCTICA,
Hokkaido Univ. (Japan). Graduate School of Fisheries.
For primary bibliographic entry see Field 5B.
W83-00756

SEASONAL SELECTION IN A FRESHWATER HETEROTROPHIC BACTERIAL COMMUNITY,
Tennessee Univ., Martin. Dept. of Biological Sciences.
J. N. Trentham, and T. R. James.
Microbial Ecology, Vol 7, No 4, p 323-330, December, 1981. 4 Fig, 10 Ref.

Descriptors: *Bacteria, Natural waters, *Temperature effects, Lakes, Stratification, Microbiological studies, Water analysis, Bacterial analysis, Eutrophication, Lakes, Reelfoot Lake, *Tennessee, Seasonal variation, Selectivity.

Seasonal selection was examined in the heterotrophic component of a freshwater bacterial community. Such selection would contribute to the choice between the static or dynamic hypotheses of seasonal bacterial community composition. Water samples were taken from the surface water of Reelfoot Lake, a shallow, eutrophic lake located in northwest Tennessee. The lake was formed in 1811-1812 by a series of earthquakes along the New Madrid fault. It is about 18 miles long by 4 miles wide and divided into two major open water basins by encroaching peninsulas of riparian swamp forest. It does not thermally stratify during the summer months. Evidence for seasonal selection was provided by a 6 degree C shift in the mean temperature of the counts from the summer sample to the winter sample. The selection was even more evident when the number of organisms capable of growing at 10 degrees C and those able to grow at 35 degrees C were compared over the seasonal cycle. The counts at these two incubation temperatures varied inversely to each other. Although a negligible number of organisms from a represenative summer sample grew at 10 degrees C, 18% of the organisms from a representative winter sample grew at this temperature. The data suggest that although seasonal selection does occur, the magnitude of that selection is not great enough to permit the growth of bacteria during the coldest month to approach the levels of growth noted during summer. However, the selection appears to be adequate to allow significant activity during the spring and fall transition months. (Baker-FRC)
W83-00758

LIMNOLOGY OF HEART LAKE, ONTARIO,
Toronto University, Scarborough Coll., Toronto (Ontario).
C. Nalewajko, G. Bryant, and M. Sreenivasa.
Hydrobiologia, Vol 79, No 3, p 245-253, 1981. 4 Fig, 3 Tab, 26 Ref.

Descriptors: *Eutrophic lakes, *Limnology, Phytoplankton, Algae, Trophic level, Lakes, Heart Lake, *Ontario, Canada, Algal growth, Eutrophication, Diatoms, Stratification, Water level.

Heart Lake is eutrophic and the large summer blooms of blue-green algae have been a nuisance to recreational users. To relieve the problem and to relieve hypolimnetic anoxia which was damaging the fish, an artificial destratification program was undertaken in 1975. The result was a decrease of blue-greens and an increase of Ceratium hirundinella followed by its death and massive fish kill. Heart Lake has an area of 17.2 ha, a mean depth of 4.6 meters and a maximum depth of 9 meters. The lake is dimictic and holomictic. At the height of summer stratification the epilimnion is about 3.5 m deep, the secchi disc depth about 1 M and the hypolimnion is anoxic. The distribution of individual species of algae with depth in the epilimnion was seldom uniform, but more commonly conformed to a definite pattern. The simultaneous existence of different patterns in different species provided evidence of spatial heterogeneity (niche diversification) in the epilimnion, which could lessen any interspecific competition. Diatom stratigraphy in a 70 cm core revealed that the lake has been eutrophic throughout its history but may have gone through 3 periods, the most recent of which was the most eutrophic and which was preceeded by a period of unusually low water levels. (Baker-FRC)
W83-00774

PRIMARY PRODUCTION IN THREE LAKES OF DIFFERING SALINITY IN VICTORIA, AUSTRALIA,
Avondale Coll., Cooranbong (Australia). Dept. of Sciences.
B. V. Timms.
Hydrobiologia, Vol 79, No 3, p 233-238, 1981. 2 Fig, 3 Tab, 23 Ref.

Descriptors: *Primary productivity, *Lakes, *Salinity, *Australia, Chlorophyll A, Natural waters, Trophic levels, Eutrophic lakes, Mesotrophy, Mesotrophic lakes.

The primary production, chlorophyll-a, and trophic status of three lakes, Purrembete, Bullenmerri and Gnotuk, near Camperdown in western Victoria are described. Primary production was determined by the carbon-14 method, conducted monthly over a period of a year. In the lakes primary production was 96.2, 182.1 and 90.1 g c/sq m/year, respectively. Salinities of the three lakes were 0.4 o/oo, 8 o/oo and 58 o/oo, respectively. There was considerable dark fixation in both the saline lakes. During 1971-2 the average chlorophyll-a contents of the lakes were 9.1, 17.5 and 5.0 mg/cu m, respectively. These values may have been depressed by abnormal weather conditions. According to primary production levels, Bullenmerri was eutrophic and Purrembete and Gnotuk mesotrophic. Primary production correlated with chlorophyll-a in Purrembete and Bullenmerri, but not in Gnotuk where bacteriochlorophyll seemed to be important. Bacteria were considered responsible for the dark fixation which occurred in considerable amounts in Bullenmerri (24.8 g c/sq m/year) and Gnotuk (22.2 g c/sq m/year). (Baker-FRC)
W83-00775

THE PHOSPHORUS ECONOMY OF A HYPERTROPHIC SEEPAGE LAKE IN SCANIA, SOUTH SWEDEN GROUNDWATER INFLUENCE,
Lund Univ. (Sweden). Limnological Inst.
M. Enell.
Hydrobiologia, Vol 86, No 1/2, p 153-158, January, 1982. 3 Fig, 3 Tab, 18 Ref.

Descriptors: *Lakes, *Nutrients, *Limnology, Sediments, Chemical composition, Physical properties, Seepage, Phosphorus, Phytoplankton, Biomass, Groundwater movement, Water quality, *Sweden, Lake Bysjon.

The phosphorus economy was studied in Lake Bysjon, a hypertrophic seepage lake in southern Sweden. The large and rapid variations in chemical composition and physical characteristics of the water were investigated together with in situ relationships between biomass, productivity and species distribution of bacteria, phyto- and zooplankton. Phosphorus concentrations were determined in the lake itself (water, interstitial water and sediment), in sedimenting material and in the groundwater entering the lake. The mean dissolved inorganic phosphorus concentration for the study years (1973-1977) was 580 micrograms/liter. There were no correlations between inorganic P, total organic P, dissolved organic P, particulate P and phytoplankton biomass. Groundwater inflow and lake water outflow through the ground are the most important factors for maintaining a constant water volume. Groundwater seepage is also improtant for water quality. Groundwater inflow, together with planktonic activity, keeps the P concentration high in the lake water. (Baker-FRC)
W83-00777

EFFECT OF LIGHT INTENSITY OF SULFATE UPTAKE AND PRIMARY PRODUCTIVITY BY NATURAL FRESHWATER MICROPLANKTON COMMUNITIES AND AXENIC ALGAL CULTURES,
New York State Museum, Albany.
R. H. Monheimer.
Hydrobiologia, Vol 79, No 2, p 121-127, 1981. 3 Fig, 11 Ref.

Descriptors: *Sulfates, *Light intensity, *Microorganisms, *Algae, Metabolism, Uptake, Benthic environment, Primary productivity, Culturing techniques, Natural waters, Fate of pollutants.

Field and laboratory studies are presented on axenic algal cultures comparing primary productivity (inorganic carbon uptake) and sulfate uptake as they are affected by light intensity. Sulfate uptake and primary productivity were measured in both axenic algal cultures and the field using radioisotope techniques. Analyses of four years of in situ sulfate uptake by microplankton communities in two trophically different lakes showed that about 12% of the experiments had dark uptake equal to or higher than uptake at ambient light. Three axenic algal cultures subjected to different light intensities showed that sulfate uptake patterns, relative to primary productivity, vary with species and although sulfate uptake tends to decrease at lower light levels, at or very near darkness, in physiologically active (young) cultures sulfate uptake frequently increases dramatically. The field data, when summarized according to the light received, shows the same trends seen in the axenic cultures. It is concluded that sulfate uptake is only loosely associated with inorganic carbon uptake (primary productivity) and that under some circumstances a low level of light may increase the sulfate uptake rate. The high rate of dark microplankton sulfate uptake occasionally observed in lakes is probably the result of the combination of inhibition by high light and the tendency of physiologically active algae to have high sulfate uptake rates in the dark. (Baker-FRC)
W83-00778

CHANGES IN QUALITY OF FINNISH INLAND WATERS REVEALED BY GROUPING ANALYSIS,
National Board of Waters, Helsinki (Finland).
R. Laaksonen.
Hydrobiologia, Vol 86, No 1/2, p 159-160, January, 1982. 2 Tab, 3 Ref.

Descriptors: *Water quality, *Inland waterways, *Water analysis, Monitoring, Lakes, Conductivity, Alkalinity, Nitrogen, Oxygen, Grouping analysis, Finland, Nonpoint pollution sources.

Grouping analysis offers a fresh aproach to monitoring the quality of inland water bodies. In this study it has been applied to certain parameters from a network of stations on lake deeps. General trends were sought by examining the distribution of the means for 1971-1977 among five classes created by grouping the means for 1965-1970. Marked changes in water quality are seen to have taken place, mainly in lakes whose condition was almost natural (loss of purity). These changes are indicated by differences in the distributions of the values for conductivity, alkalinity, total nitrogen and oxygen. The results suggest an increase in the importance of loading from non-point sources. (Baker-FRC)
W83-00791

SHALLOW DREDGING AS A STRATEGY FOR THE CONTROL OF SUBLITTORAL MACROPHYTES: A CASE STUDY IN TUGGERAH LAKES, NEW SOUTH WALES,
Victoria Ministry for Conservation, Queenscliff (Australia). Marine Science Labs.
For primary bibliographic entry see Field 5G.
W83-00831

LIMNOLOGY OF A EUTROPHIC RESERVOIR: BIG BEAR LAKE, CALIFORNIA,
New York State Museum, Albany.
For primary bibliographic entry see Field 5C.
W83-00846

HOWE LAKE: A HYDRODYNAMIC BLOWOUT STRUCTURE,
Christiansen (E.A.) Consulting Ltd., Saskatoon (Saskatchewan).
E. A. Christiansen, D. J. Gendzwill, and W. A. Meneley.
Canadian Journal of Earth Sciences, Vol 19, No 6, p 1122-1139, 1982. 15 Fig, 2 Tab, 18 Ref.

Descriptors: *Lakes, *Hydrodynamics, *Blowouts, Howe Lake, *Saskatchewan, Canada, Glacial lakes, Lake morphology, Manville Group, Pressure, Glaciers, Glaciation.

A field investigation was made of the Howe Lake area in Saskatchewan. The Lake is anomalously circular, with a diameter of 295 meters, and deep, unlike most prairie lakes. The lake is the surface expression of a deep, funnel-shaped depression filled with coarse colluvium at the bottom and finer material near the top. A central pipe extends to a depth of at least 138 meters. Radiocarbon dates and the history of deglaciation in the area given evidence that the structure was formed between 12,000 and 12,500 years ago, shortly after the ice retreated from the area. The structure was probably formed by a hydrodynamic blowout of water from the Mannville Group 400 m below surface. The extreme overpressure of water in the Mannville Group was probably induced by recharge from meltwater of the continental glacier then standing a few kilometers to the north of Howe Lake. The blowout was initiated at Howe Lake by fractures in the subsurface, related to a salt solution-collapse structure. Howe Lake probably served as a valve controlling the artesian pressure in the Mannville Group over a large area until the active ice margin had retreated northeastward, exposing lower elevation discharge areas. Hydrodynamic blowouts provide another process for the orgin of breccia-filled pipes. (Baker-FRC)
W83-00847

EVIDENCE OF MICROBIAL SUCCESSION ON DECAYING LEAF LITTER IN AN ARCTIC LAKE,
Cincinnati Univ., Ohio. Dept. of Biological Sciences.
T. W. Federle, and J. R. Vestal.
Canadian Journal of Microbiology, Vol 28, No 6, p 686-695, June, 1982. 10 Fig, 28 Ref.

Descriptors: *Decaying organic matter, *Nitrogen, *Microorganisms, Lakes, *Arctic region, Leaf litter, Littoral zone, Toolik Lake, *Alaska, Adenosine triphosphatase.

The sequence of events occurring during the microbial colonization and decomposition of aquatic macrophyte litter in the littoral zone of a large arctic lake was examined. Colonization was assessed by measuring the concentration of ATP associated with the litter and examining the litter surface by scanning electron microscopy. Decomposition was determined by measuring weight loss and changes in the carbon, nitrogen, phosphorus, and protein content of the litter. The study site was Toolik Lake, located about 230 km north of the arctic circle and 190 km south of Prudhoe Bay. It is ice covered from October to June and is extremely oligotrophic due to low concentrations of dissolved nitrogen and phosphorus. Litter lost about 20% of its dry weight and 60% of its phosphorus by leaching during the first 4 days of exposure to lake water. Microbial activity was responsible for any additional decomposition. Microorganisms were first noted on the litter surface on the third day of incubation in the lake. ATP was not yet detected. Rapid colonization followed, associated by a steep decline in nitrogen content, a two-fold increase in protein content, and the appearance of microbially mediated weight loss of the litter. By day 13 microbial colonization declined by 50%, and it remained stabilized for the duration of the study. The decline coincided with the demise of the large filamentous forms, a decrease in the protein content of the litter and slower but continued decrease in the nitrogen content of the litter. Decomposition was dependent on the development and succession of the microbial community of the litter. (Baker-FRC)
W83-00848

ALGAL DYNAMICS IN RELATION TO PHYSICO-CHEMICAL FACTORS IN A HIGH ALTITUDE POND OF SHILLONG, INDIA,
North-Eastern Hill Univ., Shillong (India). Dept. of Botany.
L. C. Rai, and K. M. Muniyandi.
Acta Hydrochimica et Hydrogiologica, Vol 9, No 2, p 183-187, 1981. 3 Fig, 26 Ref.

Descriptors: *Algae, *Ponds, *Population dynamics, Phytoplankton, Nutrients, Shillong, *India, Euglenophyta, Cyanophyta, Chlorophyta, Bacillariophyta, Oligotrophic lakes, Succession.

Algal dynamics as related to the physicochemical factors of water were studied in a high altitude (1600 m) pond at Shillong, India, during June 1977-June 1978. Chlorophyta was the dominant one of 34 genera of algae found. Also present were Bacillariophyta, Cyanophyta, and Euglenophyta. Diatoms were most frequent in number. Bacillariophyta and Chlorphyta numbers peaked in April (90 million and 60 million cells per ml, respectively), with a minor peak in October. Cyanophyta and Euglenophyta were present ($<$ 20 million cells per ml) in lower, more uniform concentrations throughout the year. Species diversity in the pond was high throughout the year. The successional pattern of the algal species was similar to that found in temperate zone lakes. Desmid numbers were high, and nutrients were relatively low in concentration. All factors indicate that this pond is oligotrophic, gradually progressing toward mesotrophy. (Cassar-FRC)
W83-00853

PRIMARY PRODUCTIVITY IN RELATION TO THE ABIOTIC FACTORS IN A TEMPORARY FRESHWATER POND,
North-Eastern Hill Univ., Shillong (India). Dept. of Zoology.
S. A. K. Nasar, and M. Sharma.
Acta Hydrochimica et Hydrobiologica, Vol 8, No 5, p 435-442, 1980. 1 Tab, 37 Ref.

Descriptors: *Ponds, *Primary productivity, *Water quality, Productivity, Shillong, *India, Plankton, Nutrients.

The primary productivity in a small temporary pond (3.5 m long, 1.5 m wide, 1.5 m deep) was measured in winter from November to April using the bright-dark flash method. The pond is located in the Northeast hill region of India, for which no information on primary productivity has been reported. Climate is characterized by a long cold winter and a long rainy season. Some of the physical and chemical data obtained were: temperature, 9C in January and 23C in April; dissolved oxygen, 1.6-13.3 mg per liter; phosphates, 5-12.5 mg per liter; and nitrates, 0.42-1.21 mg per liter. Gross production was 0.9-11 g C per cu m per day; net production, 0.8-7 g C per cu m per day; respiration, 0.5-5.6 g C per cu m per day; and production/respiration ratio, 19.6-0.18. Rainfall had significant effects on physical and chemical properties of the water. (Cassar-FRC)
W83-00854

ELECTRON FLOW VIA SULFATE REDUCTION AND METHANOGENESIS IN THE ANAEROBIC HYPOLIMNION OF LAKE MENDOTA,
Eidgenoessische Technische Hochschule, Zurich (Switzerland).
K. Ingvorsen, and T. D. Brock.
Limnology and Oceanography, Vol 27, No 3, p 559-564, May, 1982. 1 Fig, 1 Tab, 23 Ref.

Descriptors: *Hypolimnion, *Lakes, *Lake Mendota, *Wisconsin, Thermal stratification, *Sulfates, Chemical reactions, Chemical analysis, Water analysis, *Methanogensis.

A method is described for estimating the extent of electron flow through sulfate reduction and methanogenesis during anaerobic decomposition of organic matter in the hypolimnion of Lake Mendota, Madison, Wisconsin, during summer stratification. This is done by constructing a mass balance model from changes in the vertical profiles of sulfate, sulfide, and methane during the entire period of summer stratification. Chemical profiles of the water column were determined every second or third week during stratification at a 24 meter deep site in the lake. The electron flow via sulfate reduction in the anaerobic hypolimnion was about 25% of the electron flow via methanogenesis. There is a possible stoichiometric relationship between anaerobic electron flow and anaerobic carbon mineralization. (Baker-FRC).
W83-00877

TOTAL ORGANIC CARBON IN LAKE SUPERIOR SEDIMENTS: COMPARISONS WITH HEMIPELAGIC AND PELAGIC MARINE ENVIRONMENTS,
Minnesota Univ., Duluth. Dept. of Geology.
T. C. Johnson, J. E. Evans, and S. J. Eisenreich.
Limnology and Oceanography, Vol 27, No 3, p 481-491, May, 1982. 5 Fig, 2 Tab, 31 Ref.

Descriptors: *Lake sediments, *Organic carbon, Carbon, Sedimentation, Sediments, Lakes, *Lake Superior, Great Lakes, Limnology.

Total organic carbon (TOC) was studied in Lake Superior sediments. Seventeen box cores were collected on research cruises on Lake Superior in 1977-1979. TOC was determined by wet oxidation with sulfuric acid-potassium dichromate. Organic carbon concentrations in surficial sediments averaged 3-4 wt%. Most cores show a pronounced decrease in organic carbon content with burial depth and have mean concentrations of 2.1-3.7% in sediments less than 100 years old. The lowest values averaged about 0.5% TOC and are found in the varved, glacial-lacustrine clay that underlies the uniform, postglacial clay in some cores. The mean concentration of TOC in sediments less than 110 years old was about 2.8%. The average sedimentation rate for 34 sites in Lake Superior is 77 cm/1000 years. While a correlation exists between sedimentation rate and TOC concentration in marine sediment, no such relationship was found for the Lake Superior sediment. The findings suggest that most organic carbon in Lake Superior sediments less than 110 years old is autochthonous. (Baker-FRC)
W83-00878

LAKE ONTARIO ATMOSPHERIC DEPOSITION, 1969-1978,
Department of the Environment, Burlington (Ontario).
For primary bibliographic entry see Field 5B.
W83-00954

BIOLOGICAL, CHEMICAL AND PHYSICAL RESPONSES OF LAKES TO EXPERIMENTAL ACIDIFICATION,
Department of Fisheries and Oceans, Winnipeg (Manitoba). Freshwater Inst.
For primary bibliographic entry see Field 5C.
W83-00957

LIMING OF ACIDIFIED LAKES: INDUCED LONG-TERM CHANGES,
Swedish Water and Air Pollution Research Lab., Goeteborg.
For primary bibliographic entry see Field 5G.
W83-00958

STRUCTURE AND PRODUCTIVITY OF EPIPHYTIC ALGAL COMMUNITIES ON LOBELIA DORTMANNA L. IN ACIDIFIED AND LIMED LAKES,
Lund Univ. (Sweden). Limnological Inst.
For primary bibliographic entry see Field 5G.
W83-00959

ACIDIFICATION OF NOVA SCOTIA LAKES I: RESPONSE OF DIATOM ASSEMBLAGES IN THE HALIFAX AREA,
Department of the Environment, Halifax (Nova Scotia).
For primary bibliographic entry see Field 5C.
W83-00960

CONCEPTS FOR THE MODELLING OF THE PHOSPHORUS CYCLE IN LAKES AND RESERVOIRS (MODELLVORSTELLUNGEN UBER DEN PHOSPHORKREISLAUF IN STEHENDEN GEWASSERN),
Eidgenoessische Anstalt fuer Wasserversorgung, Abwasserrenigung und Gewaesserschutz, Zurich (Switzerland).
For primary bibliographic entry see Field 5C.
W83-00971

LIMNOLOGY OF SHALLOW LAKES AND RESERVOIRS (LIMNOLOGIE FLACHER SEEN UND TALSPERREN),
Nordrhein-Westfalen Landesamt fuer Wasser und Abfall, Dusseldorf (Germany, F.R.).
G. Griedrich.
Zeitschrift fur Wasser und Abwasser Forschung, Vol 15, No 3, p 81-88, June, 1982. 9 Fig, 49 Ref.

Descriptors: *Limnology, *Lakes, *Reservoirs, *Water properties, Shallow lakes, Lake morphology, Epilimnion, Hypolimnion, Primary productivity, Macrophytes, Plankton, Eutrophication, Sediment-water interfaces, Thermal stratification, Zooplankton.

After a brief description of the limnology of standing waters in general, the specific characteristics of valley reservoirs and shallow lakes are described. Particular properties of valley reservoirs are their length, winding and often branching shape, and even downward slope of the floor toward the dam, as well as fluctuations in water level caused by water extraction. For shallow lakes, the wind is an important factor: in wind-exposed lakes, stable thermal layers cannot form. Because of the homogeneity of the shallow lake, oxygen deficiencies in the deeper layers can quickly be remedied, and the high temperatures in the water-silt contact zone result in faster metabolism and higher bioactivity than in deep lakes. Macrophytic vegetation, especially reeds, is important as a stabilizing factor and refuge for fish and animals in the shallow lake. Alleopathic effects between algae and higher plants should be studied with regard to a possible biological method for controlling algal growth in moderately organically rich shallow waters. As far as primary production of plankton and eutrophication are concerned, shallow lakes warm up faster than deep waters, and thus attain algal quantities in spring that deep lakes with comparable nutrient supplies reach only in summer, if at all, while the extraction of water from the hypolimnion in reservoirs means that during summer the epilimnion becomes dominant and development in the direction of the shallow lake occurs. The influences of macrobenthos and zooplankton are discussed, with emphasis on the significance of the latter for phytoplankton development. (Gish-FRC)
W83-00981

MONTE CARLO STUDY OF THE NATURE OF THE UNDERWATER LIGHT FIELD IN, AND THE RELATIONSHIPS BETWEEN OPTICAL PROPERTIES OF, TURBID YELLOW WATERS,
Commonwealth Scientific and Industrial Research Organization, Canberra (Australia). Div. of Plant Industry.
J. T. O. Kirk.
Australian Journal of Marine and Freshwater Research, Vol 32, No 4, p 517-532, 1981. 5 Fig, 3 Tab, 30 Ref.

Descriptors: *Monte Carlo method, *Light penetration, *Turbidity, Color, Physical properties, Mathematical studies, Model studies, Optical properties, *Australia, Light intensity, Water properties, Radiation, Prediction, Natural waters.

A Monte Carlo method is presented for computer modeling of the penetration of light into turbid, colored waters of the type commonly found on the Australian continent. For monochromatic light the structure of the underwater light field is described in terms of the variation of the average cosine (total, downward, upward) and irradiance reflectance, as a function of optical depth at a given ratio of scattering to absorption (b/a), and as a function of b/a at a given optical depth. The vertical attenuation coefficient for downward irradiance at the mid-point of the euphotic zone has been studied as a function of the absorption (a) and scattering (b) coefficients and, with the particular normalized volume scattering function used in these simulations has been found to conform to a given equation. The data generated by the model have been used in conjunction with radiative transfer theory to determine the contribution of the different components of the attenuation mechanism to the vertical diminution of irradiance at different ratios of b to a. Simulation of the penetration of photosynthetically available radiation into four water bodies in the southern tablelands of New South Wales has been carried out using measured absorption coefficients and indirectly estimated values for scattering coefficients. The calculated values for vertical attenuation coefficients are in good agreement with those obtained by measurement within the water bodies. The possible use of this model as a predictive tool is discussed. (Baker-FRC)
W83-01011

THE SIGNIFICANCE OF SURFACE TEMPERATURE PATTERNS ON THE ENERGY BALANCE OF A SMALL LAKE IN THE CANADIAN SHIELD,
Waterloo Univ. (Ontario). Dept. of Geography.
E. F. LeDrew, and P. D Reid.
Atmosphere-Ocean, Vol 20, No 2, p 101-115, 1982. 3 Fig, 3 Tab, 21 Ref.

Descriptors: *Lakes, *Evaporation, *Temperature effects, Surface temperature, Water temperature, Inversions, *Lake evaporation, Perch Lake, *Ontario, *Thermal imagery.

Temperature patterns on a small lake in the Canadian Shield were examined by means of thermal imagery. The effect of the different surface temperatures on the daytime energy balance was examined for two points over the lake at the time the thermal imagery was taken. A range of almost 6 degrees C was noted within a distance of 380 m over this shallow lake on 14 June 1979. Patterns of temperature are related to bathymetry through the volume of heated water, to surface current configuration, to the thermal properties of floating vegetation, and to the restriction of diffusion of

heated water in vegetation choked shallows. These thermal gradations force distinctly different regimes of the energy balance across the lake. At the time the thermal imagery was collected, a distinct inversion existed over the lake center, with a downward flux of sensible heat. This energy source augmented the net radiation so that the latent heat flux or evaporation was 105% of the available radiant energy. In contrast, a normal lapse was noted above the heated shoals along the downwind shore, and the daytime sensible heat flux was 9% of the net radiation, while the latent heat flux was reduced to 88%. This difference indicates that a single point estimate may introduce a bias if it is assumed to be representative of the lake average for the purposes of studying lake evaporation. (Baker-FRC)
W83-01029

FINITE ELEMENT ANALYSIS OF HORIZONTAL AND VERTICAL TURBULENT DIFFUSION PROBLEMS IN LAKES,
Canada Center for Inland Water, Burlington (Ontario).
D. C. L. Lam.
Advances in Water Resources, Vol 5, No 2, p 105-110, June, 1982. 4 Fig, 3 Tab, 15 Ref.

Descriptors: *Model studies, *Lakes, *Turbulence, *Diffusion, Vertical distribution, Horizontal distribution.

In a departure from the conventional procedure of comparing numerical schemes, a series of tests is presented which gradually involves more and more elements of the practical environmental problem. Emphasis has been progressively shifted to the opimization of the observable model coefficients, as opposed to obtaining a very accurate prediction of the dependent variable given as an exact solution. In the process of such practical realization of the problem, the advantage of using higher order accurate numerical methods quickly diminishes, because the variability of the observed data and the uncertainties of the physical hypothesis greatly influence the goodness of fit of the model results. However, this does not imply that the pursuit of more elegant methods should be slowed down. The main conclusion is that, in the seemingly endless pursuit of the perfect element shape or basis functions, one should remember that the practical demand calls for generality and efficiency, if not simplicity. (Baker-FRC)
W83-01040

2I. Water In Plants

PREDICTING THE EFFECTS OF DRAINAGE SYSTEMS ON CORN YIELDS,
For primary bibliographic entry see Field 4A.
W83-00748

PREDICTING HEIGHT AND RELATIVE PERFORMANCE OF MAJOR SOUTHERN PINES FROM RAINFALL, SLOPE, AND AVAILABLE SOIL MOISTURE,
Southern Forest Experiment Station, Pineville, LA.
E. Shoulders, and A. E. Tiarks.
Forest Science, Vol 26, No 3, p 437-447, September, 1980. 2 Fig, 5 Tab, 15 Ref.

Descriptors: *Planting management, *Regression analysis, *Pine trees, *Forest management, *Soil moisture retention, *Soil-water-plant relationships, *Moisture availability, Mathematical studies, Water requirements, Species composition, Subsoil, Forest watersheds, Seasonal distribution, Rainfall distribution, Slopes, Available water.

The effects of rainfall, slope and soil available moisture storage capacity on the 20-year performance of loblolly (Pinus taeda L.), slash (P. elliottii Engelm, var. elliottii), longleaf (p. palustris Mill.), and shortleaf (p. echinata Mill.) pines in the Gulf Coastal Plains were examined by regression analysis to learn if water regimes may be used to reliably predict the tree species to favor on a particular site. Results showed that 46 to 60% of the variation in 20-year heights of dominant and codominant pines was associated with warm and cool season rain, slope, and potential available moisture storage of the subsoil. On loamy or sandy loam soils, loblolly should be taller than slash only if annual rainfall averages less than 140 cm. warm season rainfall averages less than 76 cm, and the subsoil potential available moisture storage capacity is about 7%. On silty loam or finer textures subsoils or on deep sands, loblolly excels only if average annual rainfall does not exceed about 132 cm and is distributed nearly equally between warm and cool seasons. Under the majority of moisture schemes examined, loblolly and slash should be taller than longleaf and shortleaf at 20 years. (Geiger-FRC)
W83-00769

MODELING SOYBEAN LEAF-WATER POTENTIALS UNDER NONLIMITING SOIL WATER CONDITIONS,
Agricultural Research and Education Center, Bradenton, FL.
C. S. Stanley, T. C. Kaspar, and H. M. Taylor.
Agronomy Journal, Vol 73, No 2, p 251-254, March-April, 1981. 4 Fig, 3 Tab, 9 Ref.

Descriptors: *Water potential, *Leaves, *Evapotranspiration, Model studies, *Soybeans, Soil-water-plant relationships, Water stress, Solar radiation, Air temperature, Regression analysis, Iowa, Diurnal variation.

A model for predicting the diurnal leaf water potential response of soybean was developed, using readily obtainable weather and environmental data (solar radiation, air temperature, pan evaporation, relative humidity, and wind speed). When only solar radiation and air temperature were used as input variables, coefficients of determination for regression models were 0.86-0.88 under nonlimiting soil water conditions. There were no significant differences among the 5 cultivars studied. The model was verified at a location in Iowa 200 km from the site used to develop the model. Most water potentials were accurate within + or - 1 bar. This model should be useful in developing a soybean growth model and in irrigation scheduling to maintain a no-stress level. This model is limited in application to nonlimiting soil water conditions, to cultivars of similar morphology, to similar environmental conditions, and to comparable plant growth periods. (Cassar-FRC)
W83-00824

WATER USE BY WHEAT AND PLANT INDICATORS OF AVAILABLE SOIL WATER,
Soil and Irrigation Research Inst. Pretoria (South Africa).
W. S. Meyer, and G. C. Green.
Agronomy Journal, Vol 72, No 2, p 253-257, March/April, 1980. 4 Fig, 12 Ref.

Descriptors: *Evapotranspiration, *Soil-water-plant relationships, *Water use, Leaves, Water potential, Lysimeters, Growth rates, Wheat, Irrigation requirements, Root systems, Water use efficiency.

The water relations of wheat were studied in weighing lysimeters containing soil characteristics of the surrounding high veld plateau of South Africa. Watering treatments were: WW, well-watered, with replenishment at 50% depletion of available soil moisture; WD, well-watered until July 30 only; and D, watered sufficiently to prevent plant death on August 14 only. Plants with well-watered root systems extracted 80% of the available soil moisture at or near potential evapotranspiration rates before a decline in rate of water use was apparent. Plants with less-developed roots extracted only 70%. Measurement of leaf and stem length during the drying cycle showed that 52-57% of the available water was extracted before the plant growth rate if the drying treatments fell below that of well-watered plants. The approximate days on which plant growth began to decline were: WW, 235; WD, 230; and D, 195. When water use rate began to decline, the predawn or covered plant leaf water potential rapidly decreased. This was caused by resistance to movement of water through the soil to the roots, not by a plant-induced resistance. These results confirm the validity of the general practice of irrigating before more than 50% available water is depleted. (Cassar-FRC)
W83-00828

INFLUENCE OF POTASSIUM SOURCE (SEDIMENT VS. OPEN WATER) AND SEDIMENT COMPOSITION ON THE GROWTH AND NUTRITION OF A SUBMERSED FRESHWATER MACROPHYTE (HYDRILLA VERTICILLATA (L.F.)
Waterways Experiment Station, Vicksburg, MS.
J. W. Barko.
Aquatic Botany, Vol 12, No 2, p 157-172, February, 1982. 4 Fig, 5 Tab, 41 Ref.

Descriptors: *Macrophytes, *Potassium, *Nutrients, *Nitrogen, *Phosphorus, Natural waters, *Sediments, Sedimentation, Interstitial water, *Hydrilla.

The relative availability of potassium to Hydrilla verticillata Royle from sediment versus overlying solution was examined. The influence of a heterogeneous assemblage of sediments on the growth of this species is reported. The sediment-based nitrogen and phosphorus nutrition of Hydrilla is considered in relation to the growth of this species. Sediments include differed substantially in their textural and organic matter composition. Interstitial water concentrations of calcium, magnesium, and potassium were significantly intercorrelated and reflected differences in the overall ionic strength of source waters. Total sediment concentrations of these nutrients suggests substantial geochemical differences in the watersheds associated with the lakes and sites from which the sediments were obtained. Potassium concentrations in total sediments and in their interstitial waters span nearly a 10-fold range, but are generally lower than those reported for sediments and in their interstitial waters span nearly a 10-fold range, but are generally lower than those reported for sediments obtained from agriculturally enriched reservoirs located in the mid-western United States. Nitrogen and phosphorus were mobilized effectively from all sediments in relation to respective tissue nutrient demands incurred by Hydrilla during its growth. Potassium was mobilized from all sediments to only a minor extent by this species and its mobilization was proportional to interstitial water potassium concentration. The open water rather than the sediment appears to be the primary source of K supply to this species and perhaps to most other submersed freshwater macrophytes. Where K was supplied in solution, sediment-related differences in the growth of Hydrilla negatively correlated with organic matter in the sediment. (Baker-FRC)
W83-00830

WATER DEFICIT EFFECTS ON WATER POTENTIAL, AND WATER USE OF COWPEAS,
Science and Education Administration, Temple, TX. Grassland, Soil and Water Research Lab.
P. Shouse, S. Dasberg, W. A. Jury, and L. H. Stolzy.
Agronomy Journal, Vol 73, No 2, p 333-336, March-April, 1981. 3 Fig, 5 Tab, 20 Ref.

Descriptors: *Water deficit, *Growth stages, *Irrigation requirements, Water use efficiency, Irrigation efficiency, Crop yield, Cowpeas, Water stress, Leaves, Water potential, Drought, Evapotranspiration, Soil-water-plant relationships.

The effect of water deficit imposed at three growth stages (vegetative, flowering, and podfilling) on the yield and water use of cowpeas (Vigna ungiculata L. Walp.) was studied. The six treatments were: control (well-watered) and five deficit treatments in which water was withheld or applied at different combinations of the three growth stages. Cowpeas were grown on a sandy loam soil in Riverside, California, during 1976-77. The predawn leaf water potential was a better indicator of plant water stress during a drying cycle than a midday leaf water potential value. The stages of growth most sensitive to water deficit were

flowering and podfilling, with yield reductions of 35-69%, depending on the timing and length of drought. A soil water deficit during the vegetative stage had the least effect on crop yield. Water use efficiency was greatest (5.15) when water was withheld during the vegetative stage and applied during flowering and podfilling stages and least (1.96) when water was applied during the vegetative stage and withheld for the two later stages. Control water use efficiency was 4.41. Seed yield of cowpeas was linearly related to an integrated water stress indicator based on the predawn measurement of leaf water potential. Relative dry matter yield was linearly related to crop transpiration as determined by the difference between a water balance measurement of evapotranspiration and modeled evaporation. (Cassar-FRC)
W83-00835

CROP EVAPORATION, SURFACE RESISTANCE AND SOIL WATER STATUS,
Nottingham Univ. (England). Dept. of Physiology and Environmental Studies.
G. Russell.
Agricultural Meteorology, Vol 21, No 3, p 213-226, April, 1980. 14 Fig, 1 Tab, 16 Ref.

Descriptors: *Soil-water-plant relationships, *Evaporation, *Surface resistance, *Barley, *Pastures, Soil moisture deficiency, Soil water potential, Water stress.

Rates of evaporation from barley and pasture were calculated from rainfall and soil water measurements in two sandy loam fields in the eastern Midlands of England. Both crops lost water at about the same rate, 2.1 mm per day, during May 21-July 31. Evaporation from pasture exceeded that from barley in April and early May when barley had a small leaf index area and in August-September after barley had been harvested but pasture grass was still growing. Surface resistance in the barley field was high in April, fell to a minimum in May, and lose again towards harvest. In pasture surface resistance was minimum in early June and gradually increased throughout the season. During a dry year the surface resistance was much higher (up to 200 s per m) than in other years (up to 160 s per m) for both crops. Relationships were established between the supply of water (as measured by soil water deficit or soil water potential) and the response to a shortage of water (as measured by the surface resistance or ratio of actual to potential evaporation). Differences in response of the two crops were due to differences in the water release curves rather than to species differences. (Cassar-FRC)
W83-00856

EFFECTS OF REPEATED APPLICATION OF WATER STRESS ON WATER STATUS AND GROWTH OF WHEAT,
Duke Univ., Durham, NC. Dept. of Botany.
N. Sionit, I. D. Teare, and P. J. Kramer.
Physiologia Plantarum, Vol 50, No 1, p 11-15, September, 1980. 4 Fig, 1 Tab, 24 Ref.

Descriptors: *Wheat, *Irrigation water, *Plant growth, *Water stress, *Plant water potential, *Growth stages, Water requirements, available water, Stress, Wilting, Wilting point, Water potentials, Soil-water-plant relationships, Dehydration, Growth kinetics.

The effects of water stress on the water status and growth of controlled cycles of a semi-dwarf spring wheat (Triticum aestivum L.) were examined in experiments conducted in controlled environment chambers. Water stress was applied by withholding irrigation at the beginning of the 7th leaf, early anthesis or early dough stages od development. A second cycle was started 9 to 13 days after termination of the first cycle and was maintained until the flag leaf water potential reached -25 bars at each growth stage. Lower leaves showed signs of wilting in the first drying cycle at -7 bars and in the second cycle at -9 bars of leaf water potential during all stages of growth. Re-watering prompted complete recovery, although senescence began 3 days earlier in stressed plants. A preliminary drying cycle did not increase a plant's ability to withstand stress. At all three stages of growth, a water stress of -25 bar reduced seed yield, an effect which was enchanced with a second stress cycle. Stress applied during early anthesis produced the smallest and fewest seeds. The lack of osmotic adjustment was attributed to the severity and suddeness of the development of water stress. (Geiger-FRC)
W83-00875

SEASONAL PATTERNS OF SOIL WATER RECHARGE AND EXTRACTION ON SEMIDESERT RANGES,
Rocky Mountain Forest and Range Experiment Station, Albuquerque, NM.
For primary bibliographic entry see Field 2G.
W83-00932

THE MEANING OF MATRIC POTENTIAL,
Commonwealth Scientific and Industrial Research Organization, Canberra (Australia). Div. of Plant Industry.
J. B. Passioura.
Journal of Experimental Botany, Vol 31, No 123, p 1161-1169, August, 1980. 2 Fig, 15 Ref.

Descriptors: *Mathematical equations, *Plant water potential, *Hydrostatic pressure, Water potentials, Osmotic pressure, Mathematical studies, Plant physiology, Plant tissues.

A misleading mathematical expression which equates plant water potential with the hydrostatic pressure minus the sum of the osmotic pressure and the matric potential is redefined. The term for matric potential, which is supposed to reflect the effect of a solid phase on plant water potential, will be equal to zero if a consistent definition of pressure is used in the standard thermodynamic derivation. The expression can be corrected by substituting the sum of the plant water potential and the osmotic pressure of the equilibrium dialysate of the system for the term for matric potential. The practical and theoretical significance of the corrected equation are discussed. (Geiger-FRC)
W83-00964

2J. Erosion and Sedimentation

VERTICAL DISTRIBUTION OF 137-CS AND ITS ACCUMULATION RATE IN LAKE SEDIMENTS,
Kyoto Univ. (Japan). Geophysical Research Station.
K. Kamiyama, S. Okuda, and M. Koyama.
Japanese Journal of Limnology, Vol 43, No 1, p 35-38, January, 1982. 3 Fig, 1 Tab, 9 Ref.

Descriptors: *Lakes, *Sedimentation rates, Sediments, Sedimentation, Lakes, Lake sediments, Bottom sediments, Lake Biwa, Lake Suigetsu, Lake Mikata, *Japan, Limnology.

THe vertical distribution of Cs-137 in sediments of lakes in Japan was investigated. Possible sedimentation rates were estimated based on the data obtained. Samplings of lake sediment cores were conducted in 1979, using three lakes, Lake Biwa, Lake Mikata, and Lake Suigetsu; the latter was the only brackish lake to be included. The sedimentation rates in the central area of Lake Biwa range from 0.12 to 0.26 cm/year, with rates in the coastal area of Lake Biwa being somewhat higher than those in the central area, though sediment perturbation is undeniable. The rate in Lake Suigetsu is 0.12 cm/year, and the rate in Lake Mikata is over 0.20 cm/year. Since Lake Mikata is very shallow it is undeniable that surface sediments were mixed by wave action and other factors. (Baker-FRC)
W83-00780

PHYSICAL PROCESSES AND SEDIMENTATION ON A BROAD, SHALLOW BANK,
Louisiana State Univ., Baton Rouge. Coastal Studies Inst.
S. P. Murray, S. A. Hsu, H. H. Roberts, E. H. Owens, and R. L. Crout.
Estuarine, Coastal and Shelf Science, Vol 14, No 2, p 135-157, February, 1982. 15 Fig, 2 Tab, 26 Ref.

Descriptors: *Sedimentation, *Banks, *Physical properties, Stream banks, Estuaries, Estuarine environment, Coastal waters, Water currents, Carbonates, Beaches, Rainfall, *Nicaragua, Miskito Bank.

An integrated study was performed of the meteorology, physical oceanography, sedimentation and coastal morphology on the broad, shallow Miskito Bank off the eastern coast of Nicaragua. Systematic interrelationships between driving forces, geometry and sedimentologic environments on the Bank were revealed during the course of the investigation. Extremely high rainfall results from an interaction between meteorological processes over the Bank and topographic effects along the coast. Both acoustic and radio sounding of the lower atmosphere have documented the feedback between convective plumes, inversion layers and the incessant rainfall, which brings three times more freshwater and 15 times more sediment down to a unit length of coast than on the U.S. Atlantic shore. The resultant brackish, turbid coastal water moves as a highly organized band of water parallel to the coast. Seaward of this coastal boundary layer, offshore water from the Caribbean Current rides up on the Bank, providing an environment for carbonate production. A zone of fine-grained terrigenous sediment underlying the coastal boundary current merges abruptly into a smooth carbonate plain covering most of the surface of the Bank. These central Bank carbonates are composed primarily of the disintegration products of prolific calcareous green algae. A trend of high relief, luxurient coral reef growth is aligned along the steep dropoff at the Bank edge, a zone of observed upwelling of cooler and saltier basin water. A threefold southerly increase in wave energy at the shoreline due to the decreasing width of the shallow shelf results in wave-dominated coastal morphologies in the south compared to fluvial domination in the north and a systematic change from straight, linear bars and beaches in the north to rhythmic topography in the south. (Baker-FRC)
W83-00816

SEDIMENT-DELIVERY RATIOS FOR A SMALL COASTAL PLAIN AGRICULTURAL WATERSHED,
Science and Education Administraition, Tifton, GA. Southeast Watershed Research Lab.
J. M. Sheridan, C. V. Booram, Jr., and L.. E. Asmussen.
Transactions of the ASAE, Vol 25, No 3, p 610-615, 622, May/June, 1982. 4 Fig, 5 Tab, 22 Ref.

Descriptors: *Coastal plains, *Sediment transport, Watersheds, Rainfall-runoff relationships, Sedimentation, *Sediments, Prediction, Estimating, Seasonal variation, *Agricultrual watersheds, Storm runoff, Erosion.

Sediment-delivery ratios were determined for Wateshed K, a small complex-cover Coastal Plain agricultural watershed near Tifton, Georgia in order to describe seasonal variations in sediment delivery rations, and to develop relationships for predicting sediment-delivery ratios for use in engineering-design estimates. Measured total sediment loss from the drainage area was divided by the estimated gross soil movement within the drainage area and then multiplied by 100 to determine sediment delivery ratio (SDR) values for the selected time period. SDR values were examined monthly, seasonally, and annually. Equations suitable for estimating SDR values for periods other than the study period were developed by regression analyses. SDR values were highest during months when neither gross sediment movement nor sediment yields were at annual maximums. The SDR values peaked, instead, during months of moderate gross movement and moderate yield. The variability of SDR values with time throughout the year was evident. The overall results indicated that the traditional annual-based sediment-delivery ratio in predicting sediment yields on a storm or short-term basis may cause significant errors in estimating the quantity of sediment moving from Coastal Plain drainage areas. Season was the predominate individual predictor of observed variations in SDR values. (Baker-FRC)
W83-00869

ARE NEW ZEALND STREAM ECOSYSTEMS REALLY DIFFERENT.,
Canterbury Univ., Christchurch (New Zealand). Dept. of Zoology.
M. J. Winterbourn, J. S. Rounick, and B. Cowie.
New Zealand Journal of Marine and Freshwater Research, Vol 15, No 3, p 321-328, 1981. 2 Tab, 61 Ref.

Descriptors: Streams, *Ecosystems, *Sedimentation, Rivers, Feeding rates, Aquatic life, Natural waters, Rainfall, Benthos, Benthic environment, Benthic fauna, Benthic flora, *New Zealand.

New Zealand is a small country with a complex diverse landscape including prominent mountain ranges. The timber line is low and consequently extensive river catchments occur above the forest in terrain which is oftensteep and barren. Scree slopes are a continual source of the sediments carried down mountain streams. Since heavy rainfalls occur unpredictably and frequently, it is not surprising that sediment yields measured in several New Zealand rivers are among the highest in the world. At higher taxonomic levels New Zealand stream faunas show numerous differences from their Northern Hemisphere counterparts although in some groups there is a predominance of cosmopolitan species. Throughout the land unmodified streams tend to have remarkably similar faunas with a nucleus of common genera and species. This faunal similarity extends to streams in exotic plantations as well as in native forest and grassland, a significant point for stream management planners. Changes in community structure along unperturbed streams in New Zealand appear to be related primarily to physical factors, especially to stream size, slope, and stability, and secondarily to the nature of the energy sources available to the fauna. The importance of coarse particualte organic matter as a major source of energy to small forest communities is noted. At first glance stream ecosystems appear to be anything but integrated, closed systems displaying tight, or complex organization, feedback loops, and so on. Rather they are dominated by continual, but not necessarily predictable, recruitment of materials and organisms from outside and losses or displacement of some of these downstream, and it is only the continual nature of their supply which serves to perpetuate stream communities. (Baker-FRC)
W83-00885

HYDRAULIC INTERPRETATION OF GRAIN-SIZE DISTRIBUTIONS USING A PHYSICAL MODEL FOR BEDLOAD TRANSPORT,
State Univ. of New York at Binghamton. Dept. of Geological Sciences.
J. S. Bridge.
Journal of Sedimentary Petrology, Vol 51, No 4, p 1109-1124, December, 1981. 12 Fig, 88 Ref.

Descriptors: *Bed load, *Sediment transport, *Model studies, *Sediment load, *Sedimentation, Bed-load discharge, Hydraulcs, Sedimentary petrology, Petrology, Particle size.

Grain-size distributions of bedload sediment are modeled by considering the time variation of sediment transport in a unidirectional turbulent flow. A frequency distribution of instantaneous bed shear stress is divided into a large number or shear stress ranges. The mean value of each stress range is capable of transporting a range of sediment sizes as bedload; the maximum size is just at its entrainment threshold, while the minimum size is just too large to be suspended. Rates of bedload transport are calculated for each size range using a theoretical bedload function, and the proportion of time during which these rates occur is obtained by integrating the frequency distribution between the boundaries of each shear stress range. The relative weights of sediment transported in particular size ranges, determined for all the mean values, constitute the grain size distribution obtained from bedload sampling at a fixed point on the bed. Cumulative grain size curves have been simulated using the model in order to demonstrate the effects of the various model parameters such as mean bed shear stress and viscosity. All curves showed a distinct 'break' in slope, which represents the maximum grainsize tranpsportable in suspension when the shear stress attains its maximum fluctuating value. Examination of many natural bedload distributions showed close qualitative and quantitative agreement with the model, and reasons for discrepancies can be fully explained. Typical grain size distributions of deposited sediments can be obtained by mixing different flow related bedload distributions in various proportions. Thus although deposited sediments may primarily result from bedload transport during a steady flood flow, flow unsteadiness also plays a part. The effects of some deposition directly from suspended load can also be surmised. (Baker-FRC)
W83-00929

THE APPLICABILITY OF THE GIBBS EUATION FOR GRAIN SETTLING VELOCITIES TO CONDITIONS OTHER THAN QUARTZ GRAINS IN WATER,
Oregon State Univ., Corvallis. School Oceanography.
P. D. Komar.
Journal of Sedimentary Petrology, Vol 51, No 4, p 1125-1132, December, 1981. 5 Fig, 2 Tab, 8 Ref.

Descriptors: *Settling velocity, *Gibbs equation, Density, Minerals, Quartz, Sediments, Mathematical equations, Particle size, *Sedimentation, *Settleable solids.

The applicability of the Gibbs equation to other grain densities, fluids, and to gravity fields other than Earth's was investigated. A comparison is made with 'data' generated from a standard drag coefficient versus Reynolds number curve that is applicable to the settling of spheres in any Newtonian fluid. This comparison shows that the Gibbs et. al. relationships cannot be used for gravity fields other than Earth's or for fluids other than water. In each case of deviation from these two conditions the errors became extreme. Their relationships do yield good results over the range of grain densities represented by the common heavy minerals settling in water. As the density progressively departs from that of quartz, the amount of error increases, reaching 8.5% for densitites as high as magnetite. A correction factor is introduced which is a function of grain density, the use of which greatly improves the estimated settling velocities of the common heavy minerals and of low-density materials such as foraminifera shells. (Author's abstract)
W83-00930

COMPOSITION OF MODERN STREAM SAND IN A HUMID CLIMATE DERIVED FROM A LOW-GRADE METAMORPHIC AND SEDIMENTARY FORELAND FOLD-THRUST BELT OF NORTH GEORGIA,
New Mexico State Univ., Las Cruces. Dept. of Earth Sciences.
G. H. Mack.
Journal of Sedimentary Petrology, Vol 51, No 4, p 1247-1258, December, 1981. 12 Fig, 1 Tab, 21 Ref.

Descriptors: *Streambeds, *Sedimentation, *Humic climates, Sediments, Sedimentary petrology, Petrology, Metamorphic rocks, Sandstones, Humidity, Climates, Humid areas, Quartz, Sand, *Georgia.

Conditions of tectonics and drainage in north-central Georgia provide an excellent natural laboratory to study the composition of stream sand derived from a low-grade metamorphic and sedimentary foreland fold-thrust belt under humid climatic conditions. The streams head in a high-relief phyllite, schist, and metasandstone terrain and flow westward across a bounding fault into lower relief Paleozoic shales, cherty carbonates, and quartz arenites. The relative abundance of the source rock types in the drainage basin of each sample site was determined, and a 'source rock ratio' was calculated as the ratio of the area underlain by metamorphic rock to the total area of the drainage basin. Low-grde metamorphic source rocks supply subequal amounts of monocrystalline quartz, polycrystalline quartz, and foliated quartz-mica rock fragments to stream sediment, whereas sand from the sedimentary source terrain consists primarily of monocrystalline quartz, a suprisingly large number of pelitic rock fragments, and chert. Mixing of sediment from both source rock types is recognizable on the quartz provenance diagram of Young by a high instability index and a low polycrystallinity index. This diagram is especially sensitive to the presence of sandstones as source rocks, which further decreases the polycrystallinity index. The ratio of metamorphic rock fragaments to total rock fragments is also direcly related to the source rock ratio. The concepts derived from the recent sand are applied to the Mississippian Parkwood Formation, Alabama, and the Cretaceous Muddy Formation, Montana. The results suggest that both sandstone units were derived from foreland fold-thrust belts, but that the Parkwood source area contained a greater proportion of low-grade metamorphic source rocks than the source area of the Muddy. (Baker-FRC)
W83-00931

SEDIMENTOLOGY OF MUDDY FINE-GRAINED CHANNEL DEPOSITS IN MEANDERING STREAMS OF THE AMERICAN MIDDLE WEST,
Michigan Univ., Ann Arbor. Dept. of Geological Sciences.
R. G. Jackson, II.
Journal of Sedimentary Petrology, Vol 51, No 4, p 1169-1192, December, 1981. 18 Fig, 2 Tab, 42 Ref.

Descriptors: *Streams, *Sediments, *Mud, Sedimentary petrology, Petrology, Accretion, Channel accretion, *Illinois, *Indiana, *Wisconsin, Channels.

Many tributary valleys to major streams in Illinois, Indiana and Wisconsin were sites of mud deposition in late Wisconsinan periglacial lakes. Today the flat lacustrine plains of these valleys contain freely meandering streams. The subaqueous bed material is a complex, variable mixture of quartzose sand, mud, mud blocks, equant mud clasts, rock fragments, and plant debris. Point-bar topography is restricted to bends of low or moderate curvature; bends of greater curvature show dominantly erosional inner banks. An organic-rich ooze lies beneath the stagnation zone that develops near the inner bank of highly curved sectors. Subaerial sediment on depositional surfaces is primarily a muddy sand with variable content of plant detritus. The lateral-accretion deposits near the downstream end of bends were divided into a fine member and a coarse member, the former two to four times as thick as the latter. The coarse member is dominantly a fine-to-medium quartzose sand, contains mud clasts towards the base, and is inferred to be large-scale trough cross-stratified. Logjam debris appears near the thalweg in places. Lateral-accretion bedding in the form of intercalated sand and mud-sand is inferred to extend throughout the fine member. Substantial local variations in cross-sectional geometry and channel lithofacies, especially near logjams, reduce the precision of existing paleohydrologic relations and the comprehensiveness of a single lithofacies model. This class of meandering stream produces lateral accretion deposits which are closer analogues in lithofacies to the classical upward-fining model than are deposits from the graveliferous sand-bed streams that have received primary emphasis from sedimentologists. (Baker-FRC)
W83-00933

IMPACT OF INCREMENTAL SURFACE SOIL DEPTHS ON INFILTRATIONS RATES, POTENTIAL SEDIMENT LOSSES, AND CHEMICAL WATER QUALITY,
Utah State Univ., Logan. Coll. of Natural Resources.
S. M. Lyons, and G. F. Gifford.
Journal of Range Management, Vol 33, No 3, p 186-189, May, 1980. 1 Fig, 5 Tab, 8 Ref.

Descriptors: *Infiltration, *Sediment yield, *Water quality, *Erosion effects, *Utah, Runoff, Watershed management, Nutrients, Nitrates, Potassium, Phosphorus.

Infiltration rates, sediment loss, and runoff water quality were studied at two Utah sites, Blanding (sandy loam) and Milford (silt loam), from October

1974 to August 1976 to determine the effects of removing 7.6 cm increments of soil from the surface. Treatments involved removing 7.6, 15.2, 22.9, or 30.5 cm layers of soil. Rainfall was simulated with a Rocky Mountain infiltrometer a an average rate of 8.2 cm per hour for 28 min. Infiltration rates were not significantly different among treatment depths, with one exception. However, there were significant differences in infiltration capactities between the two sites. Infiltration capacity was 14% less in 1976 than in 1975, probably as a result of soil surface clogging by fine wind-deposited soil particles. Potential sediment production (1065-9933 kg per ha) was not significantly different between sites or among treatment depths at a site. Potassium concentration in runoff water, averaged for both sites and all treatments, decreased with the depth of soil removal, from 3.6 ppm at the original surface to 2.1 ppm at the 30.48 depth. Potassium concentrations in runoff water were 1.2 ppm in Blanding and 4.3 ppm at Milford, reflecting the differences in soil composition. Phosphorus concentrations in runoff were not significantly different with depth of treatment, but were different between the 2 sites. Nitrate levels were too low for effective analysis of data. (Cassar-FRC)
W83-00934

SEDIMENT TRANSPORT ON A GENTLE SLOPE DUE TO WAVES,
Delaware Univ., Newark. Dept. of Civil Engineering.
N. Kobayashi.
Journal of the Waterway Port Coastal and Ocean Division, Proceedings of the American Society of Civil Engineers, Vol 108, No WW3, p 254-271, August, 1982. 8 Fig, 3 Tab, 21 Ref.

Descriptors: *Sediment transport, *Model studies, *Oscillatory waves, Waves, Slopes, Bed load, Sediment load.

The motion of sediment particles on a plane gentle slope has been analyzed on the basis of a quasis-teady assumption. The instantaneous rate of bed load transport has been expressed in terms of the shear stress acting on the slope which may vary with time as well as along the slope. The analysis has then been limited to the case of pure oscillatory flow, resulting in an analytical relationship for the net rate of bed load transport due to the effect of the gentle slope. The present theory has been shown to be in reasonable agreement with experiments conducted on a horizontal bed, corresponding to zero slope, in pure oscillatory flow. The relationship for the net rate of bed load transport has been applied to the analysis of infilling of relatively small and symmetric trenches due to wave action, including the influence of the disposal distance of dredge spoil on the infilling. The simple model, which takes account of the effect of a gentle slope only, explains the main features of the observed infilling of the test pits for San Francisco's ocean outfall, and the observed smoothing of ice gouges in the Southern Beaufort Sea. (Baker-FRC)
W83-00937

TEMPORAL VARIABILITY OF SUSPENDED PARTICULATE CONCENTRATIONS IN THE NEW YORK BIGHT,
National Oceanic and Atmospheric Administration, Miami, FL. Atlantic Oceanographic and Meteorological Lab.
R. A. Young, T. L. Clarke, R. Mann, and D. J. P. Swift.
Journal of Sedimentary Petrology, Vol 51, No 1, p 293-305, March, 1981. 11 Fig, 1 Tab, 30 Ref.

Descriptors: *Suspended soils, *Temporal distribution, *Bights, *New York Bight, Sounds, Bays, Sedimentation, Sediments, Spatial distribution, Sampling.

Both temporal and spatial variability of the suspended matter concentration field on the inner continental shelf were examined. Long-term instrument measurements of near bottom suspended matter showed that the highest concentrations and bulk of transport occurred during relatively brief periods of the total sample time, characterized by high wave activity and strong mean flows. Large changes in concentration were observed at wave periods (5-20 sec) as well as longer periods (hours to days). The variability of suspended matter was greatest for long-period phenomena, such as storms. There was only the slightest suggestion that tidal fluctuations made a unique contribution to the overall variance. It is concluded that the normal strong seaward gradient of concentration at all depths on the inner shelf acts to mask or smooth the effects of sampling error due to undersampling. This result applies mainly to fair-weather situations. The concentration gradient is the result of increasing distance from the source and a decrease in the frequency of resuspension and upward mixing of bottom sediments by oscillatory currents induced by surface waves. High frequency suspended matter variability has apparently a negligible effect on regional sampling since regional distributions depend primarily on wind-induced flow events. In the New York Bight such flow events occur at about 3-10 day intervals. (Baker-FRC)
W83-01045

2K. Chemical Processes

HYDROGEN AS AN ELECTRON DONOR FOR SULFATE-REDUCING BACTERIA IN SLURRIES OF SALT MARSH SEDIMENT,
Essex Univ., Colchester (England). Dept. of Biology.
For primary bibliographic entry see Field 2L.
W83-00701

THE PHYSICO-CHEMICAL HYDROLOGY OF A TROPICAL SEASONAL RIVER-UPPER OGUN RIVER,
Ibadan Univ. (Nigeria). Dept. of Zoology.
For primary bibliographic entry see Field 2E.
W83-00706

THE BEHAVIOUR OF METHYLENE BLUE ACTIVE SUBSTANCE (MBAS) IN BOTTOM MUDS UNDER LABORATORY CONDITIONS,
Gunma Inst. of Public Health, Maebashi (Japan).
M. Uchiyama.
Japanese Journal of Limnology, Vol 42, No 3, p 176-179, July, 1981. 3 Fig, 7 Ref.

Descriptors: *Bottom sediments, *Chemical reactions, *Detergents, Methylene blue active substances, Sedimentation, Lake sediments, Sediments, Chemical analysis, Mud.

The behavior of methylene blue active substances (MBAS) in bottom muds was investigated. Particular attention was given to the interaction between the interstitial water and the bottom mud particles. The bottom muds used were collected from a tiny basin into which domestic effluents flowed. MBAS were extracted from the muds by the ultrasonic extraction method. About 10 g of mud were extracted three times ultrasonically with 100 ml methanol. After the methanol was evaporated, the residue was dissolved in 100 ml distilled water by the ultrasound method and the solution was used for determining MBAS. The study suggests that after diffusing into the interstitial water of the bottom muds from the overlying water, MBAS are adsorbed on the mud particles and accumulated in the bottom muds. In the bottom muds there is an equilibrium between MBAS in dissolved form in the interstitial water and in the overlying water, and a new equilibrium is attained by the changes in the conditions such as water temperature, ion strength of water and MBAS concentration in the water column. (Baker-FRC)
W83-00717

ESTIMATION OF MULTIPLE INFLOWS TO A STREAM REACH USING WATER CHEMISTRY DATA,
Science and Education Administration, Tucson, AZ. Southwest Rangeland Watershed Research Center.
For primary bibliographic entry see Field 2E.
W83-00722

SODIUM MOBILITY IN A MINI-CATCHMENT STUDIED WITH RADIOACTIVE TRACERS AND ARTIFICIAL PRECIPITATION,
Central Inst. for Industrial Research, Oslo (Norway).
For primary bibliographic entry see Field 5B.
W83-00753

RUNOFF CHEMISTRY AT A MINI-CATCHMENT WATERED WITH 'UNPOLLUTED PRECIPITATION,'
Central Inst. for Industrial Research, Oslo (Norway).
For primary bibliographic entry see Field 5B.
W83-00754

EQUILIBRIUM STATUS OF SOME MINERAL SPRINGS IN VICTORIA,
Royal Australian Air Force Academy, Point Cook (Australia). Dept. of Chemistry.
B. A. Schaefer, and M. Kecskemeti.
Australian Journal of Marine and Freshwater Research, Vol 32, No 3, p 335-351, 1981. 6 Fig, 4 Tab, 43 Ref.

Descriptors: *Equilibrium, *Mineral springs, *Chemical composition, Victoria, *Australia, Chemical reactions, Water quality, Calcium, Sodium, Hydrogen ion concentration, Water temperature, Sediments, Minerals.

The chemical composition of 26 mineral springs in the Daylesford district of Victoria, Australia was determined at regular intervals over about 2 years, and the possible equilibria were examined. All the springs have a similar composition, but a common reservoir is doubtful. A similar mechanism for the origin of the waters appears to operate throughout the region. For the springs on a line approximately east-west and about 1 km north of the Dividing Range, the water compositions are those expected for an equilibrium between kaolinite and montmorillonite (Ca and Na). To the north of this line the composition is appropriate to water in equilibrium with montmorillonite, while to the south the water composition relates to kaolinite. The geographical distribution of the composition shows a rough relationship to the rainfall, with the higher rainfall being associated with the equilibrium line. The equilibrium which appears to be established in the area may involve the potassium and sodium feldspars. The concentration of carbon dioxide is about 14% in excess of the calculated equilibrium value for the existing conditions of pH, HCO3(-) and temperature. Evidence confirms that the probable source of the CO2 lies in the vicinity of Babbington's Hill. It is suggested that the main source of the cations in solution is the basalt rather than the altered sediments of the region. (Baker-FRC)
W83-00760

FORMATION OF FRESHWATER FE-MN COATINGS ON GRAVEL AND THE BEHAVIOR OF CO60, SR90, AND CS137 IN A SMALL WATERSHED,
Oak Ridge National Lab., TN. Environmental Sciences Div.
For primary bibliographic entry see Field 5B.
W83-00788

THE VALUE OF IODIDE AS A PARAMETER IN THE CHEMICAL CHARACTERISATION OF GROUNDWATERS,
Birmingham Univ. (England). Dept. of Geological Sciences.
For primary bibliographic entry see Field 2F.
W83-00901

QUALITY OF UNDERGROUND IRRIGATION WATERS IN SEMI-ARID TRACT OF DISTRICT AGRA. III. TEHSILS BAY AND FATEHABAD,
Raja Balwant Singh Coll., Agra (India). Dept. of Agricultural Chemistry.
D. V. Singh, B. Pai, and R. Kishore.
Annals of Arid Zone, Vol 20, No 1, p 48-52, March, 1981. 2 Tab, 6 Ref.

Descriptors: *Irrigation water, *Saline water, *Water quality, Agra District, *India, Groundwater, Semiarid lands, Wells, *Water analysis.

Analysis of 185 irrigation waters from sections of Agra District, India, showed that most were of the Na-Mg-Ca type dominated by bicarbonate ions and had < 4 mmhos per cm conductivity. High residual sodium carbonate was found in 30% of shallow wells and tube wells. Water from deep wells (150-225 mm) was saline and unsuitable for irrigation. (Cassar-FRC)
W83-01023

ISOTOPIC IDENTIFICATION OF GASES OF A DEEP ORIGIN IN FRENCH THERMOMINERAL WATERS,
Bureau de Recherches Geologiques et Minieres, Orleans (France). Service Geologique National.
For primary bibliographic entry see Field 2F.
W83-01047

INFORMATION ABOUT THE ORIGIN OF THERMOMINERAL WATERS AND GAS BY MEANS OF ENVIRONMENTAL ISOTOPES IN EASTERN AZERBAIJAN, IRAN, AND SOUTH-EAST FRANCE,
Paris Univ., Thonon-les-Bains (France). Center for Geodynamic Research.
B. Blavoux, J. Dazy, and J. Sarrot-Reynauld.
Journal of Hydrology, Vol 56, No 1/2, p 23-38, March, 1982. 5 Fig, 4 Tab, 28 Ref.

Descriptors: *Geothermal studies, *Thermal water, *Isotope studies, Geochemistry, Geohydrology, *France, *Azerbaijan, Springs, Hot springs, Mineral springs, Geologic faults, Groundwater movement, Carbon isotopes, Tritium, Deuterium, Massif Central, Alps, Acidic water, *Iran.

Analysis of deuterium, tritium, carbon-13 and oxygen-18 was used to determine the origin of thermomineral waters in two locations: Azerbaijan, Iran, and southern France. Both areas are located on large, recently-active geologic faults, the Tabriz in Iran, and on secondary fractures in the Massif Central and western Alps of France. Tritium contents in spring waters varied from nondetectable to 21 tritium units in Iran, indicating some springs of magmatic or ancient, deep origin and others supplied by mixtures of old and meteoric water. Tritium contents in French springs varied from nondetectable to nearly the 100 tritium units found in modern precipitation. The homogeneous O18 and deuterium contents in Azerbaijan springs, despite differences in altitude, indicate recharge by rain water. The Iranian springs, enriched in O18 by isotope exchange with wall rocks, emerge from reservoirs (300-340 C) hotter than all but one of the other springs in the group. In the French spring waters the widely varying O18 values were dependent on the altitude of their recharge zones. Most of the C13 levels in free CO2 indicated deep CO2 from the upper mantle. Higher C13 levels in some Iranian springs showed an origin in the thermal decomposition of carbonate rocks. The C13 depletion in certain French springs suggests an isotopic exchange of magmatic CO2 with organic C in coal beds. (Cassar-FRC)
W83-01050

2L. Estuaries

HYDROGEN AS AN ELECTRON DONOR FOR SULFATE-REDUCING BACTERIA IN SLURRIES OF SALT MARSH SEDIMENT,
Essex Univ., Colchester (England). Dept. of Biology.
D. B. Nedwell, and I. M. Banat.
Microbial Ecology, Vol 7, No 4, p 305-313, December, 1981. 3 Fig, 1 Tab, 22 Ref.

Descriptors: *Bacteria, *Salt marshes, Sediments, Sedimentation, Chemical reactions, Warburg respirometer, Hydrogen, Sulfates, Tidal marshes, Marshes, *England, Essex, Colne Point saltmarsh, Sulfate-reducing bacteria.

Experiments were carried out with slurries of saltmarsh sediment to determine whether hydrogen was important as an electron donor for the sulfate-reducing bacteria present in the sediment. Sediments were taken from the 0-5 cm horizon of a creek site at the Colne Point saltmarsh, Essex, England. These were used to prepare a slurry with aged seawater deoxygenated by bubbling with oxygen-free nitrogen. There was a steady rate of hydrogen consumption by the sediment slurry. No such uptake of gas occurred in the control flasks under nitrogen. When the contents of the sidearms were added to the slurry in the respirometer flask, hydrogen uptake continued in those flasks to which seawater was added, but substantially decreased when molybdate was added. The Warburg respirometer experiment clearly demonstrated that there was significant hydrogen consumption by microorganisms other than methanogenic bacteria. Further studies with sediment slurry held in conical flasks under an atmosphere of nitrogen showed that hydrogen accumulated in the headspace when bacterial sulfate reduction was inhibited by either the addition of 20 mM molybdate or low sulfate concentrations in the slurry. Methanogenesis was stimulated in the presence of a hydrogen atmosphere or by the addition of 20 mM molybdate. Thus hydrogen was an important electron donor for sulfate-reducing bacteria present in the sediment. The stimulation of methanogenesis by molybdate could be explained in part by a competition for hydrogen sulfate reducing bacteria and hydrogen metabolizing methanogenic bacteria, but competition for another common substrate, possibly acetate, could also be significant. (Baker-FRC)
W83-00701

COMMUNITY METABOLISM OF INTERTIDAL FLATS IN THE EMS-DOLLARD ESTUARY,
Groningen Rijksuniversiteit (Netherlands). Dept. of Microbiology.
F. B. van Es.
Marine Biology (Berlin), Vol 66, No 1, p 95-108, 1982. 7 Fig, 7 Tab, 47 Ref.

Descriptors: *Tidal flats, *Respiration, *Carbon, *Bacteria, Animal metabolism, Regression analysis, Temperature effects, Primary productivity, Aquatic productivity, Nutrients, Water pollution effects, Estuaries, Intertidal areas, *The Netherlands, Ems-Dollard Estuary.

The flux of carbon through the intertidal flats of the Ems-Dollard estuary was calculated by means of community metabolism measurements at six fixed stations. The effects of temperature, solar radiation, salinity, and type of sediment in each season were investigated. Multiple regression analysis indicated that the temperature alone and temperature plus viable bacteria explained 50 and 70% respectively of the variation in community respiration. Annual value for community respiration was 177-794 gm 02/sq m/yr and annual primary production was 82-628 gm 02/sq m/yr. The bulk of organic matter in the sediment played little part in the carbon flux. The effect of organic waste discharges on community metabolism was unclear. There were high production rates and high respiration rates at a site with high nutrient concentrations and reduced grazing pressure brought about by waste discharge. (Small-FRC)
W83-00702

DYNAMICS OF PHYTOPLANKTON IN THE BRACKISH WATER INLET POJOVIKEN, SOUTHERN COAST OF FINLAND,
Tvarminne Zoological Station, (Finland).
A. Niemi.
Hydrobiologia, Vol 86, No 1/2, p 33-39, January, 1982. 5 Fig, 25 Ref.

Descriptors: *Phytoplankton, *Stratification, *Water circulation, Algae, Estuaries, *Brackish water, Pojoviken, *Finland, Population dynamics, Species composition, Density stratification, Inlets, Baltic Sea, Ice cover, Seasonal variation.

Phytoplankton dynamics follows a seasonal pattern in Pojoviken, Finland, a stratified brackish water sea inlet on the Baltic Coast. A shallow 6 m sill restricts water exchange between the inlet and the sea. After ice-breakup (late April) primary production is depressed because of high turbidity and poor light penetration. As turbidity decreases in the spring phytoplankton production increases to a maximum in mid-June (0.5-1.0 g C per sq m per day). By late June nutrient levels reach an annual minimum. Chlorophyll a concentrations decrease in July unless river discharge is higher than normal. Stratification produces a shallow oligohaline surface layer (salinity < 2.5 o/oo) which keeps phytoplankton from circulating below a critical depth, 6-7 m, much shallower than the Secchi depth would indicate. Production in the inlet continues to be significant through November, after it has ended in the outer archipelago and sea zones. During fall the phytoplankton remain in the euphotic layer the whole time, efficiently using the weak sunlight. Ice cover ends the growing period. Chlamydomonas spp. are dominant after ice-breakup, succeeded by fresh water diatoms if the salinity remains below 2 o/oo, by Diatoma elongatum (Lyngbye C.A. Ag.) if salinity is over 2.5 o/oo, and by marine species if salinity is over 3 o/oo. In autumn fresh water diatoms are dominant. (Cassar-FRC)
W83-00709

SALINITY LEVELS AND WATER EXCHANGE IN GAMO LAGOON,
Tohoku Univ. Sendai (Japan). Geophysical Inst.
K. Hanawa, E. Kikuchi, and Y. Kurihara.
Japanese Journal of Limnology, Vol 42, No 3, p 168-175, July, 1981. 8 Fig, 1 Tab, 6 Ref.

Descriptors: *Lagoons, *Salinity, *Tidal effects, Estuaries, Salts, Estuarine environments, *Japan, Tidal rivers, Salt marshes, Tidal marshes, Gamo Lagoon, Nanakita River estuary.

Salinity distribution, tidal variations and water exchange are studied based on data which focuses on the relationship between the Gamo Lagoon and the Nanakita River estuary. According to the salinity of water entering the lagoon during the flood, there were three types of salinity distributions and corresponding tidal variations. Type 1 salinity approached that of sea water. Type 2 represented an intermediate case between the two. Type 3 salinity was near to that of river water. The type 2 classification was closely related to the states of salinity distribution in the estuary, especially to the position of the salt-wedge interface at flood or high tide. It was thus shown that the combination of tide and river discharge heavily influenced the salinity in a lagoon adjoining a salt-wedge type estuary. From the viewpoint of water exchange, the lagoon was divided into two regions for all of the above three salinity types. One was the southern region, covered at high tide, with the water entering the lagoon during flood and its water flowing from the inner region at low tide. The other was the inner region, where the water remained in the lagoon at low tide and was forced to concentrate with the advance of the tide. Water exchange rates for the residual water in the lagoon were found to be nearly 0.25 from the data collected for the spring tide. (Baker-FRC)
W83-00716

SEABED DRIFTER MOVEMENT IN SAN DIEGO BAY AND ADJACENT WATERS,
Naval Oceans Systems Center, San Diego, CA.
R. R. Hammond, and W. J. Wallace.
Estuarine, Coastal and Shelf Science, Vol 14, No 6, p 623-634, 1982. 6 Fig, 8 Tab, 27 Ref.

Descriptors: *Bays, *Bottom currents, *Powerplants, *San Diego Bay, *California, Estuaries, Docks, Drift, Water currents, Tidal currents, Coastal waters, Seabed drifters, Cooling water, Flow pattern.

In San Diego Bay, California, and the adjacent ocean 500 seabed drifters were released to study bottom flow patterns. The cresent shaped 20 km long and 4 km wide bay has a narrow channel through which tides and river water flow. The distinct bottom drift regimes and their mean residual bottom drifts (in km per day) were: 0.02 in the docking basins, 0.03 in the open bay, 0.11 in the main channel, 0.17 off the coast, and 0.44 in the surf-dominated water. Two trends were observed

in the southern bay. The first is movement north towards the central part; the second is movement towards the south toward the South Bay powerplant, which uses and discharges considerable quantities of cooling water. In the main channel and northern rim the bottom current moves inward and meets the opposing northward current, forming a null zone at the Silver Gate power station. In summer practically no fresh water dilution takes place in the bay, which is classified as an inverse embayment where evaporation exceeds fresh water input. The powerplants' use of 5% or more of the maximum tidal prism for cooling has significant, as yet unquantitated, effect on the bay's circulation. This information is useful in hydrodynamic models and for an understanding of the transport of bottom debris, sludge, and sediment. (Cassar-FRC)
W83-00738

PHYSICAL PROPERTIES OF GREAT BARRIER REEF LAGOON WATERS NEAR TOWNSVILLE. I. EFFECTS OF BURDEKIN RIVER FLOODS,
Australian Inst. of Marine Science, Townsville.
E. Wolanski, and M. Jones.
Australian Journal of Marine and Freshwater Research, Vol 32, No 3, p 305-319, 1981. 11 Fig, 13 Ref.

Descriptors: *Lagoons, Water properties, *Physical properties, *Salinity, *Great Barrier Reef, *Australia, Plumes, Jets, Estuarine environment, Estuaries, *Floods, Runoff, Burdekin River, Rivers, Water currents, Water circulation, Tidal floods, Tidal effects, Coastal waters.

In order to more fully understand the physical properties of the Great Barrier Reef Lagoon, the two-dimensional distribution of several parameters was routinely measured along a transect between Cape Ferguson and Keeper Reef at a weekly interval throughout 1979. Additionally, during river floods in 1979 and 1980, the distribution of these parameters was measured along the surface of the lagoon. During flooding following widespread inland rainfall, the flood discharge of the Burdekin River was several times larger than the discharge of other streams in the area. As a result, salt water was completely flushed from the delta during floods. Because the freshwater discharge took place through a number of distributaries, near-field jet mixing of freshwater in the sea was not very effective. The fresh water was only diluted by seawater in the ratio of 1:1.5. A number of aerial observations of the Burdekin River plume found the plume to be deflected to the north, stretching along the coastline. At the peak of the first flood the plume was roughly 5 km wide at 60 km from the river mouth. The plume was separated by sharp discontinuities in salinity from both offshore waters and water masses trapped in Bowling Green Bay. No lateral entrainment by ambient turbulence was apparent at the offshore edge of the plume, since the front was very sharp and no eddies were visible. Thus surface currents were converging on both sides of the front by buoyance. Eddies were shed behind Cape Bowling Green and lateral mixing was enhanced. Superimposed on this salinity structure was a shallow summer thermocline which disappeared at the lateral boundary of the plume, perhaps due to upwelling. Offshore, direct rainfall was the dominant factor affecting salinity. (Baker-FRC)
W83-00759

CARBON ISOTOPE COMPOSITION OF ORGANIC SESTON AND SEDIMENTS IN A GEORGIA SALT MARSH ESTUARY,
Georgia Univ., Sapelo Island. Marine Inst.
E. B. Sherr.
Geochimica et Cosmochimica Acta, Vol 46, No 7, p 1227-1232, July, 1982. 2 Fig, 4 Tab, 24 Ref.

Descriptors: *Estuaries, *Carbon, Organic matter, Seston, Estuarine environment, Coasts, Sediments, Sedimentation, Salt marshes, Tidal marshes, Marshes, *Georgia, Chemical composition, Chemical analysis.

The importance of riverborne terrestrial material as a source of organic matter to the estuary was examined. The export of Spartina carbon from the marsh, and the variability of the carbon isotope composition of pools of organic matter in the estuary were studied. Studies were made in three sounds in the Spartina marsh estuaries along the Georgia coast, which had high, moderate and low inputs of freshwater. Organic matter in all three sounds had similar carbon isotope compositions, for the most part within the range of marine values. The river flow did not apparently introduce significant quantities of particulate C plant material to Georgia estuaries. Evaluation of the total carbon isotope values of estuarine seston and three size fractions of sediment indicated that, while Spartina carbon can be an important component of organic matter in intertidal sediments, it is hardly present at all in the seston. The isotope composition of estuarine dissolved inorganic carbon appeared to be influenced by respiratory carbon dioxide derived from metabolism of C13-depleted plant carbon. Phytoplankton production using this comparatively light dissolved inorganic carbon could be a source of relatively negative total C13 carbon in the estuary. Additonal origins of estuarine organic matter greatly depleted in C-13 compared to Spartina carbon remain to be identified. (Baker-FRC)
W83-00787

PHYSICAL CHARACTERISTICS OF AN INSHORE AREA ON THE ATLANTIC COAST OF BRITTANY AND THEIR INFLUENCE ON THE PELAGIC ECOSYSTEM: THE CASE OF THE 'RIVIERE D'ETEL',
Universite de Bretagne Occidentale, Brest (France). Lab. d'Oceanographic Biologique.
J. Le Fevre, J.-C. Cochard, and J.-R. Grall.
Estuarine, Coastal and Shelf Science, Vol 13, No 2, p 131-144, August, 1981. 3 Fig, 2 Tab, 21 Ref.

Descriptors: *Estuarine environment, *Productivity, *Seasonal variation, *Stratification, Mixing, Estuaries, Pelagic ecosystem, Ecosystems, Riviere d'Etel, Temperature effects, Water temperature, Phytoplankton, Zooplankton, Vertical distribution, Runoff, Water circulation, Salinity, *France.

The 'Riviere d'Etel' is a tidal embayment which serves as a common estuary for several minor rivers. A tidal embayment of such a kind can be expected to have an important influence on the water circulation in the open sea off its mouth, and, therefore, on the evolutin of the pelagic ecosystem there. From May to September of 1976 a survey was carried out to investigate the relationship. During most of this period, freshwater runoff was virtually nonexistent as a result of a drought. However, a particular hydrographic regime was still observed off the mouth of the Riviere d'Etel, and pelagic ecosystem dynamics could be accounted for by a rather simple interaction between weather conditions and seawater tidal transit in the embayment. A gradual increase of both temperature and salinity was noted at the sampling stations from the beginning of the survey to August. Then a decrease occurred. Vertical stratification was an important characteristic in the area, being maximal in June and early July. Salinity was almost identical throughout the column, and therefore temperature differences entirely accounted for this stratification. This system of density circulation was dependent on calm weather. When winds and waves were strong extensive vertical mixing occurred. The pelagic ecosystem appeared to be regulated by this opposition between density circulation and vertical mixing. Density circulatin resulted in dinoflagellate dominance and low productivity of phytoplankton, resulting in a paucity of zooplankton. Vertical mixing resulted in diatom dominance, high phytoplankton productivity, and a correlative richness of zooplankton, the dominant organisms being a mixture of inshore and offshore species. Temperature, the other important factor, regulated both the abundance of meroplankton and the seccession of dominant holoplanktonic animal species. (Baker-FRC)
W83-00792

INTERACTIONS BETWEEN SUSPENDED ORGANIC MATTER AND COPEPOD GRAZING IN THE PLUME OF THE HUDSON RIVER,
Medgar Evers Coll., Brooklyn.
M. B. Chervin, T. C. Malone, and P. J. Neale.
Estuarine, Coastal and Shelf Science, Vol 13, No 2, p 169-183, August, 1981. 5 Fig, 7 Tab, 35 Ref.

Descriptors: *Organic matter, *Rivers, *Copepods, *Grazing, Hudson River, Plumes, Estuarine environment, Seasonal variation, Productivity, Vertical mixing, Mixing, Temperature effects, Biomass, Phytoplankton, Suspended solids.

Copepod grazing is evaluated in terms of interactions between phytoplankton, suspended organic matter and assimilation rates by copepods. Interactions are discussed in terms of article size spectra, nutritional quality, and the influence of non-photosynthetic particles on the ability of copepods to graze phytoplankton. Samples were collected within 2 hr or local apparent noon while following surface drogues launched near the mouth of the Hudson-Raritan estuarine complex. Daily observations were made over 11-14 day periods in March, May, July and November, so that the plume was monitored during environmental extremes in terms of temperature, vertical mixing and the biomass and productivity of phytoplankton. Temperature and phytoplankton biomass had positive effects on assimilation rates and nitrogen: carbon assimilation ratios. Rates of phytoplankton assimilation increased more rapidly than non-phytoplankton assimilation, and a greater proportion of assimilation was invested in copepod growth as phytoplankton biomass increased. As a consequence, net copepod production was directly dependent on the assimilation of phytoplankton, even though non-phytoplankton organic matter accounted for the most organic carbon assimilated, on the average. Food chain transfer efficiency increased from about 1% in March to 25% in July. Copepod grazing limited phytoplankton and non-phytoplankton crops during July, but not during March, May or November. Copepods assimilated about 38% of phytoplankton production, largely as a consequence of recycling. (Baker-FRC)
W83-00793

ENVIRONMENTAL CHARACTERISTICS OF THE MANDOVI-ZUARI ESTUARINE SYSTEM IN GOA,
Department of Environment, New Delhi (India).
S. Z. Qasim, and R. S. Gupta.
Estuarine, Coastal and Shelf Science, Vol 13, No 5, p 557-578, November, 1981. 9 Fig, 6 Tab, 33 Ref.

Descriptors: *Estuarine environment, *Physicochemical properties, Goa, Estuaries, Coastal waters, Physical properties, Chemical properties, Monsoons, Salt wedge, Shoals, Sandbars, Mud flats, *India, Arabian Sea.

Two rivers, the Mandovi and the Zuari, with their interconnecting canal, form an estuarine system in Goa on the west coast of India. Physical, chemical and biological features of this estuary are adapted to a seasonal rhythm induced by the annual cycle of the monsoon. Heavy precipitation and land runoff from June to September bring about large changes in temperature, salinity, flow pattern, dissolved oxygen and nutrients when the estuary becomes freshwater dominated. The monsoon season is followed by a recovery period during the post-monsoon season and then by a stable period of the pre-monsoon season when the estuary becomes marine dominated. The flow of the estuarine system is regulated by the entry of seawater with the incoming tide through Zuari, then reaching Mandovi through the canal. The flow is reversed during the outgoing tide when the estuarine system is flushed. The oxygen cycle is closely related to seasonal changes in temperature and bears an inverse relationship with salinity. In both the estuaries the sulfate/chlorinity relationship remains uniform and similar to that of the sea except during the monsoon months, when the relationship is disturbed. Changes in phosphorus, nitrogen and silicon are largely regulated by rainfall and land runoff. There was no significant difference in the phytoplankton counts between Mandovi and Zuari, these follow a rhythm similar to that of nitrate. Zooplankton biomass is higher in Zuari because of its greater marine influence. No seasonal variation was observed in the density of micro-

flora in the two rivers. Bacterial counts were observed as higher in the lower reaches of the estuarine system and decreased upstream. Based on its environmental features, this estuary system can be classified as a tide-dominated coastal plain estuary. (Baker-FRC)
W83-00804

CHEMICAL VARIABILITY IN THE TAMAR ESTUARY, SOUTH-WEST ENGLAND,
Institute for Marine Environmental Research, Plymouth (England).
A. W. Morris, A. J. Bale, and R. J. M. Howland.
Estuarine, Coastal and Shelf Science, Vol 14, No 6, p 649-661, 1982. 6 Fig, 1 Tab, 15 Ref.

Descriptors: *Saline water, *Variability, *Chemical reactions, Mixing, Estuaries, Seasonal variation, Spatial distribution, Temporal distribution, Tamar Estuary, *England, Tidal effects, Turbidity, Suspended sediments, Water temperature, Temperature, Hydrogen ion concentration, Dissolved oxygen, Oxygen.

Salinity, temperature, dissolved oxygen concentration, pH, and turbidity were measured continuously throughout the Tamar Estuary, southwest England, during monthly cruises from July 1976 to March 1978. These properties showed significant temporal variability, both short-term and seasonal, and geographic variability. In general, salinity profiles along a single transect varied smoothly, except for irregularities caused by sharp bends in the river. Small streams entering the estuary at distances > 10 km upstream exerted considerable influence on salinity distributions at times of heavy rainfall. Temperature varied from 3-5C in February to 18-21C in August. Chemical reaction rates within the estuary are likely to be 2-4 times greater in summer than in winter. pH and dissolved oxygen concentration were not clearly related to salinity. pH vaired from 8.0 to 8.2 at the seaweed border and from 6.7 to 7.5 at the freshwater border. Dissolved oxygen concentration was considerably affected by processes outside the estuarine boundary. Turbidity, the most variable of all parameters investigated, was highest (50- > 1000 ppm) in the low salinity regions and lowest at the seaward boundary (1-3 ppm). (Cassar-FRC)
W83-00807

AQUATIC DISTRIBUTION AND HETEROTROPHIC DEGRADATION OF POLYCYCLIC AROMATIC HYDROCARBONS (PAH) IN THE TAMAR ESTUARY,
Plymouth Polytechnic (England). Dept. of Environmental Sciences.
For primary bibliographic entry see Field 5B.
W83-00808

THE DYNAMICS OF ESTUARINE MANGANESE CYCLING,
Institute for Marine Environmental Research, Plymouth (England).
A. W. Morris, A. J. Bale, and R. J. M. Howland.
Estuarine, Coastal and Shelf Science, Vol 14, No 2, p 175-192, February, 1982. 12 Fig, 1 Tab, 26 Ref.

Descriptors: *Manganese, *Estuaries, *Chemical reactions, Estuarine environment, Kinetics, *England, Coastal waters, Sediments, Sediment transport, Tamar Estuary.

The dynamic nature of manganese interactions in the Tamar Estuary in south-west England was investigated in both field and laboratory studies. Pronounced temporaland spatial variability in the distribution of manganese was noted. The observed distributions were the instantaneous product of dynamic interactions involving external sources and internal sources and internal input and removal processes. Dissolved manganese was mobilized internally from reduced sediments during advective resuspension of bed material, so that this input was regulated by temporal and spatial variations in tidal stress. Manganese is returned to the sediments by continous uptake onto suspended particles. The rate of the process is responsive to changes in suspended particulate load, ionic strength, pH and temperature. The reaction changes from zero-order kinetics in freshwater to first-order kinetics characteristics of the saline medium, with marked deceleration in effective removal rate following small increases in salt concentration. Relative changes in the first order removal rate throughout the estuary are consistent, but there are considerable temporal variations in the absolute rates. This is partially attributable to variations in the quality as well as the quantity of the suspended particles. Thus the changes in the relative effectiveness of both the input and removal mechanisms, which lead to internal cycling of manganese and to variable distributions of dissolved manganese within the estuary, are closely coupled to the internal behavior of particles and hence to the tidally-induces oscillations in bed stress. (Baker-FRC)
W83-00809

LOCAL VARIABILITY IN THE DISTRIBUTION OF WINDSCALE FISSION PRODUCTS IN ESTUARINE SEDIMENTS,
International Lab. of Marine Radioactivity, Monte Carlo (Monaco). Oceanographic Museum.
For primary bibliographic entry see Field 5B.
W83-00810

SEDIMENT NUTRIENT REGENERATION IN THREE NORTH CAROLINA ESTUARIES,
Duke Univ., Beaufort, NC. Marine Lab.
T. R. Fisher, P. R. Carlson, and R. T. Barber.
Estuarine, Coastal and Shelf Science, Vol 14, No 1, p 101-110, January, 1982. 7 Fig, 4 Tab, 42 Ref.

Descriptors: *Sediments, *Nutrients, *Estuaries, Estuarine environment, *North Carolina, Phytoplankton, Primary productivity, Ammonium, Nitrate, Phosphates.

Sediment-water column exchanges of oxygen, ammonium, nitrate and phosphate were measured in three North Carolina estuaries by means of diver-installed chambers placed in the sediments. In one estuary strongly flushed by lunar tides, no significant fluxes were observed between the sandy, shelly sediments and the water column. In the other two, the organic-rich sediments exhibited exchange with the overlying water at rates similar to those reported for other environments. Oxygen consumption was not closely coupled with ammonium or phosphate, but the latter two processes were highly correlated. Nitrate exchange was very small relative to ammonium exchange. Data from this research and from general literature show a correlation of sediment inorganic N and P fluxes and the computed water solumn N and P uptake, demonstrating the sediments supply, as an annual average, 28-35% of the N and P required for the primary production of shallow marine systems. (Baker-FRC)
W83-00811

EXCHANGE OF NITRATE, AND THE PRODUCTS OF BACTERIAL NITRATE REDUCTION, BETWEEN SEAWATER AND SEDIMENTS FROM A U.K. SALTMARSH,
Essex Univ., Colchester (England). Dept. of Biology.
D. B. Nedwell.
Estuarine, Coastal and Shelf Science, Vol 14, No 5, p 557-566, May, 1982. 4 Fig, 1 Tab, 26 Ref.

Descriptors: *Nitrates, *Denitrification, *Bacteria, *Estuaries, Estuarine environment, Coastal waters, Sedimentation, Chemical reactions, Ammonia, *England, Salt marshes, Oxidation-reduction potential.

The exchange of nitrate between water and saltmarsh sediment was investigated, along with the effect of nitrate concentration of such exchange and the exchange of products of nitrate reduction between sediment and water column. Solutions containing varying concentrations of nitrate were allowable to attain steady states with respect to exchange of nitrate, ammonium and nitrite between water and sediment. The sediment had both a high affinity for nitrate and a large capacity to remove nitrate from the overlying water. Ammonium and nitrite in the effluent from each core represented only a small proportion of the total nitrate removed, the largest part disappearing from the system, presumably by denitrification with the sediment. It was concluded that the Colne Point saltmarsh sediment is an extremely effective remover of dissolved nitrate from the overlying seawater. (Baker-FRC)
W83-00812

COPEPOD COMMUNITIES IN THE ESTUARY AND COASTAL PLUME OF THE HUDSON RIVER,
Lamont-Doherty Geological Observatory, Palisades, NY.
J. C. Stepien, T. C. Malone, and M. B. Chervin.
Estuarine, Coastal and Shelf Science, Vol 13, No 2, p 185-195, August, 1981. 3 Fig, 6 Tab, 13 Ref.

Descriptors: *Copepods, *Productivity, *Coastal waters, Plumes, *Hudson River, Rivers, *New York, Phytoplankton, Seasonal variation, Biomass, Estuaries, Water circulation.

The influence of freshwater flow, large scale continental shelf circulation and storm events on the abundance and species composition of macrozooplankton was evaluated in the coastal plume of the Hudson River. Interactions between estuarine and coastal environments were evaluated in terms of time-dependent changes in species composition and species associations. Samples were collected during seasonal extremes in river flow and temperature at about weekly intervals from February to August 1977 in the estuary and at daily intervals during cruises in May, July and November 1977 and March 1978 in the plume. Seasonal variations in the abundance of macrozooplankton were similar in the estuary and plume, with a minimum during winter and a maximum during summer. Copepods dominated in both systems and were generally more abundant in the estuary than in the plume. However, more species were found in the plume, and species composition differed between systems. A seasonal succession of estuarine and estuarine-marine species was associated with changes in temperature and freshwater flow in the estuary, while the same group of estuarine-marine and coastal species dominated throughout the year in the plume. Copepod species that were abundant in the estuary were present in the plume but rarely in abundance. Similarly, stenohaline species associated with offshore water were rarely abundant in the plume. Both groups of species were good indicators of estuarine and coastal influence, which varied as a consequence of changes in river flow, vertical salinity gradients and storm events. The seasonal cycle of copepod abundance in the plume was primarily due to growth within the system rather than to circulation between systems. (Baker-FRC)
W83-00813

TRACE METAL PARTITIONING IN THE AQUEOUS SURFACE MICROLAYER OF A SALT MARSH,
Naval Research Laboratory, Washington, DC.
For primary bibliographic entry see Field 5B.
W83-00814

CONDITIONS FOR GRADIENT-TYPE DISPERSIVE TRANSPORT IN ONE-DIMENSIONAL TURBIDITY AVERAGED TRANSPORT MODELS,
Delta Works, The Hague (Netherlands). Hydraulic Dept.
J. Dronkers.
Estuarine, Coastal and Shelf Science, Vol 14, No 6, p 599-621, 1982. 10 Fig, 20 Ref.

Descriptors: *Saline water, *Mixing, *Water circulation, Estuaries, Model studies, Tidal effects, Dispersion coefficient, Oosterschelde, *The Netherlands.

The one-dimensional, tidally averaged transport models for calculating concentration distributions in estuaries assume that the dispersive mass transport is proportional to the longitudinal gradient of the cross-sectionally and tidally averaged concentration. This proportionality factor is known as the dispersion coefficient. This paper shows that the

dispersion coefficient is valid only under certain conditions: if the number of tidal periods over which the averaging time extends is larger than the time for cross-sectional mixing and if residual circulations make a small contribution to longitudinal dispersion in the estuary. However, in some situations the averaging time is limited. These situations are non-stationary pollutant releases, varying fresh water flow, and stationary releases. Salinity and velocity distribution data for the Oosterschelde, the Netherlands, are given as an illustration of the theory. (Cassar-FRC)
W83-00815

THE STRUCTURE OF THREE-DIMENSIONAL TIDE-GENERATING CURRENTS: EXPERIMENTAL VERIFICATION OF A THEORETICAL MODEL,
Bedford Inst. of Oceanography, Dartmouth (Nova Scotia). Atlantic Oceanographic Lab.
K. T. Tee.
Estuarine, Coastal and Shelf Science, Vol 14, No 1, p 27-48, January, 1982. 8 Fig, 3 Tab, 29 Ref.

Descriptors: *Model studies, *Tidal currents, *Estuarine environment, Vertical distribution, Estuaries, Coastal waters, Mathematical models, *Canada, Nova Scotia, Chignecto Bay, Bay of Fundy.

A long period of current-meter measurement taken at the entrance to Chignecto Bay at the head of the Bay of Fundy is presented. Twelve current meters were used, moored at three locations, to compare the three-dimensional (3-D) structure of the tidal current computed from Tee's simple 3-D tidal model. In order to investigate the significance of the semi-minor axis, which is a small portion of the semi-major axis, and the small vertical variation of phase and inclination, the error of the analyzed harmonic constants has been examined carefully. By using the least-square operator the new formula for estimating the error of the non-separated constituents is obtained. In order to investigate the significance of the small semi-minor axis and the small vertical variation of phase inclination of the semi-major axis, the error of the anlyzed harmonic constants has been examined in detail. New formulas for estimating the error for non-separated constituents and for the semi-major axis, semi-minor axis and the phase and inclination of the semi-major axis have been derived. A discussion of instances in which the simple formulas for limiting cases can be applied has also been included. By comparing the analyzed coefficient with Tee's simple model, it was found that by using realistic forms of the vertical eddy viscosity, the simple theoretical model reproduced the observed vertical variation of the tidal currents in the well mixed estuary reasonably well. (Baker-FRC)
W83-00817

THE APPLICATION OF RADIOISOTOPES IN THE STUDY OF ESTUARINE SEDIMENTARY PROCESSES,
Institute for Marine Environmental Research, Plymouth (England).
For primary bibliographic entry see Field 5B.
W83-00818

LONG-TERM VARIATION OF MACROINVERTEBRATE ASSEMBLAGES IN APALACHEE BAY, FLORIDA,
Florida State Dept. of Environmental Regulation, Tallahassee.
For primary bibliographic entry see Field 5C.
W83-00845

NATURAL FLUORESCENCE AS A TRACER FOR DISTINGUISHING BETWEEN PIEDMONT AND COASTAL PLAIN RIVER WATER IN THE NEARSHORE WATERS OF GEORGIA AND NORTH CAROLINA,
North Carolina Univ. at Wilmington. Dept. of Chemistry.
J. D. Willey, and L. P. Atkinson.
Estuarine, Coastal and Shelf Science, Vol 14, No 1, p 49-59, January, 1982. 6 Fig, 1 Tab, 24 Ref.

Descriptors: *Nearshore processes, *Fluorescence, *Silica, *Estuaries, Salinity, Hydrogen ion concentration, Chlorophyll a, *Georgia, *North Carolina, Coastal waters, Water temperature, Seawater, Tracer.

The possibility of using dissolved silica and natural fluorescence into the nearshore areas of Georgia and North Carolina was investigated. In the Georgia study area, dissolved silica was not suitable for use as a tracer because silica concentrations were variable and did not mix conservatively with seawater. In the North Carolina study area, dissolved silica concentrations exhibited too much short-term variability for tracer use. In both areas, natural fluorenscence was a suitable tracer. Additional investigations relevant to tracer application were made of the method for determing natural fluorescence; these include dependence on temperature of analysis, pH dependence, sample storage effect, sensitivity, correlation with total organic carbon and possible interferences from chlorophyll a, lignin sulfonates, detergents, petroleum and iron. (Baker-FRC)
W83-00857

LOCAL ENERGY EXCHANGES IN A SHALLOW, COASTAL LAGOON: WINTER CONDITIONS,
Harbor Branch Foundation, Inc., Fort Pierce, FL.
N. P. Smith, and G. H. Kierspe.
Estuarine, Coastal and Shelf Science, Vol 13, No 2, p 159-167, August, 1981. 4 Fig, 1 Tab, 9 Ref.

Descriptors: *Estuarine environment, *Model studies, *Heat budget, Energy, Computer programs, Coastal waters, *Florida, Weather, Physical properties, Water temperature.

Energy exchanges and the resultant heating and cooling associated with quasi-periodic frontal passages in a shallow, bar-built estuary are explored. Time series were obtained of the meteorological variables required to simulate local energy fluxes with a numerical model and of the water temperatures necessary to verify the computations. In this manner it was possible to describe the temporal variability and the relative importance of the the computed local energy flux processes during the study period and to determine whether water temperature could be simulated with an acceptable degree of accuracy from readily available weather data rather than on-site instrumentation. The study was conducted during a 110-day period from December 1977 through April 1978, so as to include most of the cold fronts during a winter that was considered unusually cold for South Florida. Quasi-periodic frontal passages during this time period produced cycles of heating and cooling over time scales of about a week. Temperatures decreased 4-7C during the first few days following frontal passage. Model results sugggest that the daily net water temperature change was most strongly correlated with sensible and latent heat fluxes. Heating by insolation and cooling by longwave radiation was substantial, but in both cases the correlation with the net daily temperature change was not significant. Conductive exchanges with the underlying sediments appeared to play a minor role in the estuarine heat budget. The root-mean-square error of simulated water temperatures asymptotically approached a value of about 1C for time intervals at between 2 and 30 days. (Baker-FRC)
W83-00858

EBB-TIDAL FLOW CHARACTERISTICS NEAR INLETS,
Middle East Technical Univ., Ankara (Turkey). Dept. of Marine Sciences.
E. Ozsoy, and U. Unluata.
Estuarine, Coastal and Shelf Science, Vol 14, No 3, p 251-263, March, 1982. 8 Fig, 26 Ref, 3 Plates.

Descriptors: *Turbulent flow, *Estuaries, *Inlets, Mixing, Entrainment, Jets, Tidal effects, Water currents.

The characteristics of turbulent jets issuing from tidal inlets are analyzed by taking into account lateral mixing and entrainment, bottom friction, one-dimensional bathymetric changes and ambient currents. Attention was restricted to ebbing flows from micro-tidal inlets with negligible freshwater inflow. The bottom topography is represented by arbitrary one-dimensional variations in the offshore direction. The lateral variations of bathymetry are not included but, because of the integral method used in the analysis, these variations are accounted for in an average sense, assuming the transverse variations to be small with respect to the depth scale. In the absence of depth variations, the jet expansion is exponential as a result of bottom friction, and there are circumstances in which the jet can go through stages of expansion and contraction with distance. Cross-currents in the receiving water body reduce the jet expansion rate and deflect it sideways. These and other results are discussed under the light of qualitative observations. (Baker-FRC)
W83-00859

A COMPARISON BETWEEN VERTICALLY INTEGRATED AND MULTILEVEL MODELS OF TIDAL DYNAMICS IN CHANNELS,
Bangladesh Space Research and Remote Sensing Organization, Dacca.
A. Ali.
Estuarine, Coastal and Shelf Science, Vol 14, No 4, p 405-419, April, 1982. 6 Fig, 4 Tab, 11 Ref.

Descriptors: *Channels, *Tidal effects, *Model studies, Estuaries, Estuarine environment, Numerical analysis.

A comparative study of vertically integrated and multilevel river models has been made numerically. The multilevel model is a simplified version of the earlier model presented by Johns. The study indicates the extent to which vertically integrated models are a reasonable substitute for the multilevel models. The effect of freshwater on tidal elevation and current in a river is also considered. The ertically intergrated model was found to be more sensitive to freshwater discharge than the multilevel model. The residual current was inversely proportional and the residual elevation directly proportional to the bottom friction coefficient. This, along with the results obtained by earlier studies, implies that at least in the study of the residual, the multilevel model should be used with the inclusion of the full turbulence closure scheme. Additionally, the vertical shear near the bottom friciton coefficients or a constant value may be used. The conclusions are based on the use of the tide as the main forcing function. It remains to be seen how the results will be changed by the inclusion of wind-stress forcing. The extension of the models to two horizontal dimensions would also be informative. (Baker-FRC)
W83-00860

ATTACHED AND FREE-FLOATING BACTERIA IN THE FRASER RIVER ESTUARY, BRITISH COLUMBIA, CANADA,
Simon Fraser Univ., Burnaby (British Columbia). Dept. of Biological Sciences.
C. R. Bell, and L. J. Albright.
Marine Ecology, Vol 6, No 3, p 317-327, November, 1981. 4 Fig, 8 Tab, 74 Ref.

Descriptors: *Estuarine environment, *Bacteria, Rivers, Estuaries, *British Columbia, Canada, *Biomass, *Productivity, Aquatic productivity, *Heterotrophic bacteria, Fraser River Estuary, Saline waters, Plumes, Strait of Georgia.

Biomasses, heterotrophic activities and productivities of free-floating and attached bacteria were investigated within the estuary of the Fraser River through its plume into the saline waters of the Strait of Georgia. Samples were collected from the Estuary on 6 cruises over a 13 month period. About 60% of the bacterial biomass and heterotrophic activity was assoicated with suspended particulates in the turbid Fraser River. The influence of attached bacteria decreased down the estuary as salinity increased, dropping to 15-39% of total bacterial numbers and 4% of heterotrophic activity in the Strait of Georgia. Bacteria, both attached and free-floating, were the predominant part of the microbial population in the river in terms of bio-

mass and productivity. In the Strait of Georgia, however, bacteria constituted only 4% of the microbial biomass and 25% of microbial productivity. Heterotrophic activity and productivity were stimulated in the plume to levels higher than those found in either the strait or the river. The percentage glucose respired was always found lowest in the river. (Baker-FRC)
W83-00879

ESTUARINE METAL MONITORING IN SOUTHERN BRAZIL,
Rio Grande Univ. (Brazil). Lab. de Botanica Marinha.
For primary bibliographic entry see Field 5B.
W83-00880

A FIELD STUDY OF ESTUARINE POLLUTION IN MADRAS, INDIA,
Ibadan Univ. (Nigeria). Dept. of Preventive and Social Medicine.
For primary bibliographic entry see Field 5B.
W83-00881

UNSTEADY FLOW STUDIES IN CHINA,
Colorado State Univ., Fort Collins.
For primary bibliographic entry see Field 8B.
W83-00936

HYDROMECHANICS OF TIDAL JETS,
Tetra Tech, Inc., Jacksonville, FL.
P. B. Joshi.
Journal of the Waterway Port Coastal and Ocean Divsion, Proceeding of the American Society of Civil Engineers, Vol 108, No WW3, p 239-253, August, 1982. 4 Fig, 13 Ref.

Descriptors: *Tidal hydraulics, *Mixing, *Eddies, Bottom currents, Bottom water, Viscosity, Mathematical equations, Velocity, *Florida, Coastal waters.

A unified theoretical investigation of the fully-developed region of a tidal jet is presented. The treatment presented tidal jets as plane, bottom-frictional turbulent jets subjected to changes in bottom topography. Starting with the governing continuity and axial momentum equations of the jet, it is first shown that center line velocity and the cross-stream length scale of the jet must satisfy certain conditions in order for similarity solutions to exist. Then, it is shown that these conditions lead directly to the exponential growth of the cross-stream length scale and exponential decay of the center line velocity without prior knowledge of the specific form of the similarity function. Next, Prandtl's eddy viscosity model is employed for turbulent transport, and an exact analytical solution for the similarity function is obtained. A cross-stream length scale, analogous to the jet half-width, is defined consistent with the solution of the similarity function. The variation of the length scale along the jet axis should enable one to determine constants in the theory from experimental data. Finally, the constants are related to the entrainment coefficient to complete the unified treatment of tidal jets. (Baker-FRC)
W83-00938

NEW METHOD FOR TIDAL CURRENT COMPUTATION,
Laboratoire National d'Hydraulique, Chatou (France).
J. P. Benque, J. A. Cunge, J. Feuillet, A. Hauguel, and F. M. Holly, Jr.
Journal of the Waterway Port Coastal and Ocean Division, Proceedings of the American Society of Civil Engineers, Vol 108,. No WW3, p 396-417, August, 1982. 14 Fig, 14 Ref.

Descriptors: *Model studies, *Tidal currents, *Mathematical equations, Water currents, Tidal flats, Tidal floods, Coriolis force, Wind tides, Wind, Wind-driven currents, *France, *Channels.

A new method is presented for the numerical simulation of tidal currents. This method overcomes the difficulties in the computation of two-dimensional tidal currents encountered using the Alternating Direction Implicit Method, ADI. The ADI can be subject to numerical attenuation, parasitic oscillations, and poor reproduction of wave propagation when large time steps are used. This new approach is based on a fractional step method in which monentum advection is calculated using the method of characteristics, horizontal momentum diffusion is calclated using an implicit finite difference scheme, and wave propagation is calculated using an iterative alternating direction implicit algorithm. The resulting method has been incorporated in the CYTHERE-ES1 modelling system, in which tidal flat flooding and drying as well as wind effects and Coriolis acceleration are considered. The basic principles of the method as well as its application to four schematic test causes and two engineering studies are described. (Baker-FRC)
W83-00939

MOVABLE-BED TIDAL INLET MODEL,
Iowa Univ., Iowa City. Inst. of Hydrological Research.
S. C. Jain.
Journal of the Waterway Port Coastal and Ocean Division, Proceedings of the American Society of Civil Engineers, Vol 108, No WW3, p 326-342, August, 1982. 7 Fig, 4 Tab, 6 Ref.

Descriptors: *Model studies, *Tidal hydraulics, *Channel improvement, Estuaries, Galveston Harbor, Navigation, Channels, Navigation channels, *Texas.

The effectiveness of movable-bed tidal inlet hydraulic models in predicting prototype behavior was evaluated by comparing the results of Galveston Harbor entrance model studies conducted by WES with the corresponding data from the prototype. The model and prototype shoaling rates and distributions in the navigation channel of the Galveston Harbor entrance were computed from the available model and prototype hydrographic sounding within the navigation channel for the post-construction period. In general the calibration of the models was judged unsatisfactory in terms of bed change reproduction. The shoaling rates and spatial distributions in the navigation channel of the Galveston Harbor entrance predicted by the model for the post-construction period are also not in agreement with the prototype observations. The calibration deficiencies and the differences between prototype behavior and model prediction for Galveston Harbor entrance model are believed due to the cumulative effects of the following factors: scale effects introduced by nonsimilarity between model and prototype of the physical processes; insufficient information on historical and existing prototype conditions to allow adequate calibration and operation of the model; oversimplification of the prototype data, especially that on wave climate, for reproduction in the model; and experimental errors. (Baker-FRC)
W83-00941

WATER QUALITY OF THE TIDAL POTOMAC RIVER AND ESTUARY, HYDROLOGIC DATA REPORT, 1980 WATER YEAR,
Geological Survey, Reston, VA. Water Resources Div.
For primary bibliographic entry see Field 7C.
W83-00984

SEAWATER INTRUSION IN CONTINUOUS COASTAL AQUIFER-AQUITARD SYSTEMS,
Waterloo Univ. (Ontario). Dept. of Earth Sciences.
For primary bibliographic entry see Field 2F.
W83-01028

METAL SULFIDES IN ESTUARINE SEDIMENTS,
Kean Coll. of New Jersey, Union. Dept. of Chemistry/Physics.
For primary bibliographic entry see Field 5B.
W83-01044

TEMPORAL VARIABILITY OF SUSPENDED PARTICULATE CONCENTRATIONS IN THE NEW YORK BIGHT,
National Oceanic and Atmospheric Administration, Miami, FL. Atlantic Oceanographic and Meteorological Lab.
For primary bibliographic entry see Field 2J.
W83-01045

3. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

STUDIES ON ALKALINE EARTH SULFITES--III. TRANSIENT SOLUBILITIES AND PHASE CHANGES OF CALCIUM SULFITE IN SEAWATER,
National Physical Research Lab., Pretoria (South Africa).
A. Cohen, M. Zangen, M. Koenigsbuch, and J. M. E. Goldschmidt.
Desalination, Vol 41, No 2, p 215-232, 1982. 4 Fig, 11 Tab, 27 Ref.

Descriptors: *Desalination, *Calcium sulfite, *Solubility, Water treatment, Seawater, Sulfites, Corrosion control, Sulfur dioxide.

Calcium sulfite was found to be sufficiently soluble in seawater to use as an inhibitor of corrosion and alkaline scale formation in seawater desalting plants. Samples were prepared at room temperature by two methods: (1) mixing solutions of sodium sulfite and calcium chloride and (2) passing sulfur dioxide through calcium carbonate suspensions in water. Solubilities were determined in filtered seawater, double concentrated seawater, sodium chloride solution with the same ionic strength as seawater, and distilled water. Solubilities in all solvents decreased with time and did not reach equilibrium for several weeks. This decrease was the result of a gradual transformation, by a slow dissolution-recrystallization process, of a metastable phase of crystalline calcium sulfite with a more stable, less soluble form. Solubilities also decreased slightly with temperature increases from 35 to 45C; solubilities at 75C were about half those at the lower temperatures. Transient nmolal solubilities expressed as total sulfite in natural seawater were 2.9 at 20 min, 2.2 at 24 hours, and 1.5 at 4 months. In synthetic seawater (0.7 M NaCl solution) at 25C solubilities were 3.9 nmolal sulfite at 20 min, 3.5 at 24 hours, and 2.7 at 4 months. In distilled water calcium sulfite solubilities were 0.80-1.08 nmolal sulfite at 5 min and 0.68-1.00 at 3 days. Treating seawater with 0.8 nmol sulfur dioxide per liter would produce about 0.3 n nmol per liter of sulfite. (Cassar-FRC)
W83-00712

RO SUPPLIERS LOOK TO WIND AND SUN TO POWER RURAL SYSTEMS.
World Water, Vol 5, No 7, p 33-37, July, 1982. 3 Fig.

Descriptors: *Desalination, *Reverse osmosis, Mechanical equipment, Fuel, *Wind, *Solar power.

Development of desalination systems in rural areas is hampered by the lack of conventional power supplies and by high fossil-fuel costs. The latest developments in membrane desalting technology and in alternative energy sources are reviewed. It appears that the economics and practicalities of joining the two together are becoming more and more favorable. Commercially viable desalination systems using packaged reverse osmosis (RO) which is simple to operate are needed today in various parts of the world. Such units, powered by solar thermal systems, photovoltaic cells or wind turbines are likely to compete with conventional systems as renewable energy technology advances and as the price of fossil fuel increases. The spiral-wound RO module was developed in an effort to obtain large surface areas per unit volume. Hollow-fine-fibre membranes are another development in the field. These fibers have a very thin,

dense skin which rejects dissolved salts but allows water to pass radially to the bore of the fiber and on to the product stream. Tubular membranes have been developed for limited applications in which water has a high concentration of suspended solids. Information is also given concerning the power requirements of the various desalination systems. (Baker-FRC)
W83-00969

HOW INHIBITORS IMPROVE ECONOMICS OF SCALE,
For primary bibliographic entry see Field 8G.
W83-00970

DESALTER SYSTEMS FOR MAN-MADE ISLANDS,
D. A. Jones, R. Heaton, B. D. Mallalieu, and A. E. D. Wilson.
World Water, Vol 5, No 7, p 39-42, July 1982. 3 Fig.

Descriptors: Water resources development, *Desalination, *Water supply, *Reverse osmosis, Mechanical equipment, Islands, Water demand, *Distillation.

A water supply system is proposed which is based on desalination of seawater. For industrial island complexes, the only readily available source of raw water for process and domestic use will be seawater, which could have a dissolved solids content between 34,000 and 45,000 ppm and in some cases higher. There are a limited number of physical/chemical ways of obtaining fresh water from seawater. The major choice lies between reverse osmosis and distillation. RO plants are constructed in modular fashion and thus there is effectively no size limitation. Capital costs for large RO plants are estimated at about $1,100/cu m/d, and primary energy usage approximates 20 kWh/cu m. The product water from a seawater RO plant can be expected to have a dissolved solids content of up to 500 ppm. Distillation techniques are the most widely used to date for producing fresh water from seawater. For large unit sizes, multi-stage flash evaporation is the most widely used process, but multi-effect and vapor compression distillation processes each have cost and energy requirement features capable of making inroads. The idea of combining processes has attracted design studies over a number of years, and various combinations of multi-stage flash and multi-effect and vapor compression processes have been advocated. There is scope for integrating seawater distillation and RO treatment with electric power production, whereby maximum base electrical load can be allied to dual-purpose power and water production while operating RO plants during periods of reduced electrical power export. (Baker-FRC)
W83-00979

3B. Water Yield Improvement

MITIGATING DROUGHT THROUGH WEATHER MODIFICATION: SELECTED INSTITUTIONAL AND METEOROLOGICAL ISSUES IN TEXAS; VOLUME ONE, TEXAS ADVISORY COMMISSION ON INTERGOVERNMENTAL RELATIONS,
Texas Advisory Commission on Intergovernmental Relations, Austin.
J. G. Stanford, S. Kantrowitz, G. Bomar, B. Riggio, and D. R. Haragan.
Final Report, May 1982. 273 p, 29 Fig, 7 Tab, 11 Ref, 3 Tab. 0-07-81-V0155.

Descriptors: *Weather modification, *Legal aspects, *Governmental interrelations, *Drought, *Texas, Monitoring, Institutional constraints, Economic aspects, Public participation, Cloud seeding, *Edwards Plateau.

Texas, with booming economic and population growth, faces a chronic water shortage of increasing severity, which has led to an examination of the potential for precipitation enhancement. Despite its promising potential, a complex array of scientific, fiscal, governmental, economic, political, and other institutional issues, has hindered the development of precipitation enhancement or augmentation. To illustrate the issues associated with developing a capability for efficiently using precipitation enhancement to ameliorate drought, this report focuses on the weather, economy, geography, and governmental entities of the Edwards Plateau Area of Central Texas. Texas statutory and case law, as it affects weather modification, is discussed, and the Texas Weather Modification Act and regulations are explained. Intergovernmental rain augmentation responsibilities and alternative institutional approaches are addressed, including past and potential funding sources, funding allocation methods, ways to monitor drought conditions, drought assessment and response, citizen participation, project implementation authority, economic issues, the influence of technological uncertainty on institutional involvement in weather modification, and insurance and risk management. The Palmer Index has greater value in measuring the presence of long continuing drought or wet weather conditions, while the Crop Moisture Index appears more useful in gaging the short-term effects on warm-season crops and field operations. More intensive research of cloud populations that typify drought and nondrought periods in the vicinity of the Balcones Escarpment must be done before the potential of any weather modification program can be evaluated. (Moore-SRC)
W83-00914

MITIGATING DROUGHT THROUGH WEATHER MODIFICATION: SELECTED INSTITUTIONAL AND METEOROLOGICAL ISSUES IN TEXAS; VOLUME TWO, RADAR ECHO CHARACTERISTICS IN THE EDWARDS PLATEAU - BALCONES ESCARPMENT AREA OF TEXAS,
Texas Advisory Commission on Intergovernmental Relations, Austin.
D. M. Driscoll.
Final Report, May 1982. 56 p, 13 Fig, 3 Tab, 13 Ref, 2 Append. 0-07-81-V0155.

Descriptors: *Radar, *Rainfall distribution, *Drought, *Texas, Rainstorms, *Weather modification, Diurnal distribution, Spatial distribution, *Edwards Plateau, *Balcones Escarpment.

The characteristics of rain cells (radar echoes) in the southern Edwards Plateau and Balcones Escarpment area of Texas were deduced from PPI photographs, as film, of the WSR-57 (10 cm) radar at Hondo, Texas. The periods analyzed are divided according to whether the aspect considered was initial echo occurrence or all echo occurrence. The former comprises nine very rainy (wet) days, 98 virtually rainless (dry) days, and an additional 103 unclassified days. The latter comprises a total of 699 days, but only 372 of these were fully analyzed because of time constraints. All days are from the convective seasons (April - Sept.) of the years 1973-1980. For initial echoes the characteristics documented, and stratified as either wet, dry, or unclassified, are: diurnal variations, the geographical variation of occurrence, durations to 10 km diameter (or equivalent area for non-circular shapes) of echoes that grow to this size, and durations to dissipation of those that did not. For all echo occurrences geographical regions of occurrence were specified, based on the number of grid squares which had an echo on frames at or near the hour, for eight hours a day. There is a general correspondence between initial echoes per day and both number of stations reporting rain and mean rainfall. When there are no echoes there invariably is no rain and vice versa. But the very large range of echoes is not matched by a corresponding range in rainfall characteristics. (Moore-SRC)
W83-00915

MITIGATING DROUGHT THROUGH WEATHER MODIFICATION: SELECTED INSTITUTIONAL AND METEOROLOGICAL ISSUES IN TEXAS; VOLUME THREE, PRECIPITATION CLIMATOLOGY FOR THE EDWARDS PLATEAU REGION OF TEXAS,
Texas Advisory Commission on Intergovernmental Relations, Austin.
D. R. Haragan.
Final Report, May 1982. 72 p, 34 Fig, 3 Tab, 2 Append.

Descriptors: *Precipitation, *Rainfall distribution, *Elevation, *Texas, *Weather modification, Cloud seeding, Spatial distribution, Seasonal distribution, Geological formations, Topography, Tropical storms, Thunderstorms, *Edwards Plateau.

An operational cloud seeding project designed to increase rainfall over the southern portion of the Edwards Plateau of Texas has been proposed. The Balcones Escarpment forms the southern and eastern boundary of the plateau and is believed to exert a strong influence on the spatial distribution of precipitation in the area. The Edwards Plateau region is characterized by maximum precipitation in May and September with minimum precipitation in winter and early spring. The spatial distribution of average annual precipitation shows an east-west buldge which is probably related to the abrupt rise in elevation along the Balcones Escarpment. Maps of mean monthly precipitation show evidence of topographic effects on several scales ranging from extremely localized to broad-scale features along the escarpment. During the warm season, rainfall occurs as scattered showers or thunderstorms characteristic or localized convection. Heavy precipitation in late summer and early fall is due to tropical activity moving west and north from the Gulf of Mexico. These storms are well defined and may result in heavy precipitation over only a portion of the area. Integration of the rainfall from all storms results in heavy average precipitation during the month of September. Winter precipitation is light and results primarily from overrunning of tropical air. (Moore-SRC)
W83-00916

MITIGATING DROUGHT THROUGH WEATHER MODIFICATION: SELECTED INSTITUTIONAL AND METEOROLOGICAL ISSUES IN TEXAS; VOLUME FOUR, AN OBJECTIVE STUDY OF THE UPPER-AIR CONDITIONS RELATING TO PRECIPITATION OVER THE SOUTHEASTERN SECTION OF THE EDWARDS PLATEAU IN TEXAS,
Texas Advisory Commission on Intergovernmental Relations, Austin.
W. K. Henry, T. Utley, and J. Lipe.
Final Report, May 1982. 83 p, 24 Fig, 23 Tab, 6 Ref. 0-07-81-V0155.

Descriptors: *Weather forecasting, *Precipitation, *Flooding, *Weather modification, *Texas, Cloud seeding, Rainfall, Tropical storms, Flash floods, Atmospheric water, *Edwards Plateau.

This part of Texas is almost in the center of a triangle with the three rawinsonde stations, Stephenville, Del Rio, and Victoria at the corners. Using the six summer months of eight years (1973-80) of data from these rawinsonde stations, eighteen parameters were computed for each observation period. These values were compared with the daily rainfall as reported by approximately eighty rainfall stations within the triangle. Regression equations were formulated relating the eighteen parameters to the average areal rainfall amount, and to the average areal rainfall coverage. These equations did not have good confidence scores. Then a yes-no limit analysis was made. A method is presented to forecast the days (about 50% of the days) when no seedable rain will occur. The two types of parameters which were most useful in this forecast were moisture and stability. The dynamic parameters (vorticity, convergence, vertical motion, and moisture convergence) were not good indicators. The low level moisture advection from the south across the Del Rio-Victoria leg of the triangle was the best of the dynamic parameters. Cloud seeding should not be attempted when conditions indicate the potential for damaging rainfall and flash flooding. A preliminary analysis of 23 occurrences of damaging precipitation during the study period revealed that there are two general conditions which produce flooding: tropical storms and cold front passage. Excluding tropical storms, 60% of the damaging rainfalls occurred in April and May. (Moore-SRC)
W83-00917

AIRCRAFT MEASUREMENTS OF ICING IN SUPERCOOLED AND WATER DROPLET ICE CRYSTAL CLOUDS,

Clermont-Ferrand Univ.-2, Aubiere (France).
M. Bain, and J. F. Gayet.
Journal of Applied Meteorology, Vol 21, No 5, p 631-641, May, 1982. 7 Fig, 1 Tab, 19 Ref.

Descriptors: *Ice thickness, *Cloud seeding, *Crystals, Clouds, Aircraft, Weather modification, *Spain, Icing rates.

Measurements of icing on aircraft were carried out on a DC-7 equipped with the following instrumentation: particle measuring system probes for three diameter ranges, a liquid water content probe, a total water content probe, an icing probe, a 3 cm PPI radar, and thermodynamic devices. The experiment was conducted from an airport in northwest Spain during the preliminary phase of the Precipitation Enhancement Project of the World Meteorological Organization, March 27-April 4, 1979. The ice growth regime (wet or dry) was predicted from the energy balance at the riming surface of a cylinder. Measured values of icing rate agreed reasonably well with calculated values for penetration in supercooled clouds with few ice particles. In the mixed conditions encounterd (ice crystals and supercooled droplets) icing rate was reduced by about 50%, probably because of erosion of the ice deposit by large ice particles. This effect was observed in cumuliform clouds at -21 to -8C and for ice particle concentrations > 5 per liter. (Cassar-FRC)
W83-00948

FORMATION OF ICE CRYSTALS AND DISSIPATION OF SUPERCOOLED FOG BY ARTIFICIAL NUCLEATION, AND VARIATIONS OF CRYSTAL HABIT AT EARLY GROWTH STAGES,
Cold Regions Research and Engineering Lab., Hanover, NH.
M. Kumai.
Journal of Applied Meteorology, Vol 21, No 4, p 579-587, April, 1982. 8 Fig, 1 Tab, 14 Ref.

Descriptors: *Cloud seeding, *Ice, *Crystals, Fog, Shape, Clouds, Propane, Weather modification.

The crystals were formed within 0.5 sec after liquid propane seeding in a coldroom (-0.1 to -40C). Diameters were 0.3-3 microns, mean 1.5 microns. About 80% of the ice crystals were spherical and about 20% were hexagonal. Electron microscopy revealed a grain boundary in some crystals. The production rates of ice crystals per g of liquid propane seeding increased exponentially at temperatures from -0.1 to -4C and remained at about 100 billion ice crystals per g of liquid propane seeding at temperatures below -5C. Hexagonal plates and columns were formed at temperatures of -0.1 to -40C. Hexagonal plates were also observed at -100C. Cubic crystal forms were seen at temperatures below -100C. (Cassar-FRC)
W83-00949

AN AUTOMATIC RECORDING RAINGAGE NETWORK FOR A CLOUD-SEEDING EXPERIMENT,
Commonwealth Scientific and Industrial Research Organization, Sydney (Australia). Div. of Cloud Physics.
For primary bibliographic entry see Field 7A.
W83-00950

RAINFALL RESULTS OF THE FLORIDA AREA CUMULUS EXPERIMENT, 1970-76,
National Hurricane and Experimental Meteorology Lab., Coral Gables, FL.
W. L. Woodley, J. Jordan, A. Barnston, J. Simpson, and R. Biondini.
Journal of Applied Meteorology, Vol 21, No 2, p 139-164, February, 1982. 6 Fig, 11 Tab, 47 Ref.

Descriptors: *Cloud seeding, *Rainfall, *Weather modification, *Florida Area Cumulus Experiment, Silver iodide, Statistical analysis, Precipitation, Artificial precipitation.

The main conclusion of the Florida Area Cumulus Experiment (FACE-1), 1970-76, is that dynamic cloud seeding can augment area-wide rainfall in southern Florida on selected summer days when cloud conditions are in accordance with the conceptual model. FACE-1 is a single-area, randomized, exploratory experiment. Silver iodide flares are used to seed clouds on chosen seed days. No flares or placebos are used on control days. The main observation period is 6 hours after seeding. Rainfall is estimated using 5-band radar observations adjusted by rain gages. Rain volumes in the total target (TT) area and floating target (FT) area (the most intensely treated portion of the target) are the primary response variables. Analyses without predictors show apparent increases in both location (means and median) and dispersion (standard deviation and interquartile range) characteristics of rainfall produced by seeding in the FT and TT regions. Statistical support is substantial for FT results and less for TT results. Analyses of covariance using meteorologically meaningful predictor variables suggest a larger effect of seeding with stronger statistical support. (Cassar-FRC)
W83-00962

CLEAR WATER FROM COASTAL FOGS.
World Water, Vol 5, No 7, p 22-23, 25-26, July, 1982. 1 Fig.

Descriptors: Water resources development, *Fog, *Water supply, *Chile, *Peru, Drinking water, Reforestation, Vegetation establishment, Clouds, Camanchacas, Cloud cover, Environmental effects.

Much of the coastal littoral of Peru and Northern Chile is shrouded for most of the year by thick coastal mist. Experiments in the two countries indicate that it is technically feasible to recover the water held in the mist and to reverse the desertification which is leading to impoverishment of the region. Scientists in Chile have spent 20 years studying camanchaca and have acquired considerable expertise in the technology of capturing water from the clouds. On the Peruvian side scientists have studied the impact of camanchaca on the coastal 'loma' and identified varieties of trees suited to the soils and conditions of the coastal slopes. In 1971 a United Nations hydrologist set out to find the source of the scant coastal spring waters of northern Chile through analysis of isotype samples. The spring was found to have a local origin rather than to originate in the snow covered divide of the Andes. The source was the local mist or fog which had been trapped by cactus or other vegetation and had slowly filtered through soil and rock to surface as clear spring water near the coast. It has since been demonstrated how a plantation of young trees acts as a natural water trap once the delicate root systems have become established. If the overall scheme succeeds, local projects for drinking water, forestation, reforestation, and microirrigation will be formulated and submitted to multinational organizations for funding. (Baker-FRC)
W83-00980

A REVIEW OF RAINWATER HARVESTING,
International Inst. for Land Reclamation and Improvement, Wageningen (Netherlands).
T. M. Boers, and J. Ben-Asher.
Agricultural Water Management, Vol 5, No 2, p 145-158, May, 1982. 2 Fig, 1 Tab, 105 Ref.

Descriptors: *Water management, *Reviews, Rainfall, Crop yield, Runoff, Rainfall-runoff relationships, Design criteria, Hydrography, Surface runoff, Water conservation, Land management, *Literature reviews, *Bibliographies.

Various methods of harvesting surface runoff that have a potential for application on farms in arid and semiarid regions are reviewed. Rainwater harvesting methods are defined as methods including collecting, storing, and conserving local surface runoff for agriculture in arid and semi-arid regions. Of the 170 or so articles published between 1970 and 1980, all revealed an awareness of the increasing need for rainwater harvesting and a recognition of its potential. The following elements were considered: runoff inducement including vegetation management, surface treatment, and chemical treatment; runoff collection including Micro-Catchment Water Harvesting (MCWH) and Runoff Farming Water Harvesting (RFWH); and storage and conservation. Design aspects of MCWH are reviewed, including micro-catchment size, ratio of contributing area to collecting area, and layout. MCWH is especially suitable to non-irrigated areas. The Kinematic Wave Equation and Dynamic Equations have been used in modelling MCWH. Runoff Farming Water Harvesting (RFWH) can be useful in improving irrigation water availability in surface reservoirs. For modelling RFWH, the Unit Hydrograph Method is suitable. (Baker-FRC)
W83-01025

3C. Use Of Water Of Impaired Quality

ECONOMICS OF THE WATER BLANKET TECHNIQUE FOR GREENHOUSE HEATING,
Illinois Univ. at Urbana-Champaign. Dept. of Natural Resource Economics.
J. B. Braden, S. S. Lazurus, and P. N. Walker.
American Journal of Agricultural Economics, Vol 64, No 3, p 573-577, August, 1982. 3 Tab, 16 Ref.

Descriptors: *Mathematical models, *Heated water, *Greenhouses, *Energy sources, *Cooling water, Cooling ponds, Cooling towers, Industrial water, Heat transfer, Powerplants, Weather, Model studies, *Water blanket technique.

The water blanket system of heating greenhouses is described which utilized rejected heated water from power plants. Heated reject water is pumped to the top of the greenhouse, distributed along the ridge, and allowed to flow over the roof and sides. It is then returned to the power plant. The economics of the method were analyzed using an analytical model which considers weather data in calculations of optimum energy consumption. The model was run for one-acre greenhouses in nine cities representing diverse weather conditions. Savings of natural gas were pronounced for greenhouses using water from cooling towers, while at most cooling lakes, water temperatures dropped too low during the winter. (Small-FRC)
W83-00762

REMOVAL OF NITROGEN AND PHOSPHORUS FROM UNTREATED MILKING-SHED WASTES AFTER APPLICATION TO PERMANENT PASTURE,
Massey Univ., Palmerston North (New Zealand).
For primary bibliographic entry see Field 5E.
W83-00819

WATER TYPE AND SUITABILITY OF OKLAHOMA SURFACE WATERS FOR PUBLIC SUPPLY AND IRRIGATION. PART 2: SALT FORK ARKANSAS RIVER AND CIMARRON RIVER BASINS THROUGH 1978,
Geological Survey, Oklahoma City, OK. Water Resources Div.
For primary bibliographic entry see Field 7C.
W83-00989

MAIZE CULTURE IN REED CANARYGRASS SOD TO RENOVATE MUNICIPAL WASTEWATER EFFLUENT,
Science and Education Administration, St. Paul, MN.
G. C. Marten, D. R. Linden, W. E. Larson, and C. E. Clapp.
Agronomy Journal, Vol 73, No 2, p 293-297, March-April, 1981. 1 Fig, 5 Tab, 9 Ref.

Descriptors: *Herbicides, *Infiltration, *Wastewater irrigation, Corn, Grasses, Canarygrass, Glyphosate, Paraquat, Wastewater disposal, Land application, Nitrogen removal, Irrigation water.

Herbicidal suppression of 60% of the reed canarygrass was necessary to obtain maximum grain and fodder yield from interplanted maize on an experimental field receiving municipal wastewater effluent. The silt loam soil site was adjacent to the Minneapolis-St. Paul, Minnesota, wastewater treat-

ment plant. The best herbicidal treatment was glyphosate applied at 0.56 kg AI per ha every 2 years. Annually applied paraquat at 0.56 kg AI per ha was satisfactory but sometimes produced lower yields of maize. The soil under the glyphosphate treatment was capable of sustained infiltration rates of 1.7 cm per hour. A cropping system in which maize was interseeded into herbicide-unsuppressed but partially tillage-suppressed reed canarygrass removed more nitrogen from effluent-treated soils but decreased maize dry matter yields and feed nutrients compared to the herbicide-suppressed and partially tillage-suppressed grass sod system. Feed quality of the maize grain or fodder was not influenced by the degree of grass suppression except for 2 instances of reduced crude protein concentrations of maize when grass was not sufficiently herbicide-suppressed. (Cassar-FRC)
W83-01024

3E. Conservation In Industry

STREAMFLOW INFORMATION FOR CONNECTICUT WITH APPLICATIONS TO LAND-USE PLANNING,
Geological Survey, Hartford, CT. Water Resources Div.
M. A. Cervione Jr.
Connecticut Water Resources Bulletin No 35, 1982. 35 p, 23 Fig, 7 Tab, 65 Ref.

Descriptors: *Streamflow, *Land use, *Planning, *Surface water, Hydrologic budget, Hydrologic cycle, Precipitation, Average flow, Low flow, Flow characteristics, Floods, Frequency analysis, Reservoir storage, Safe yield, Water management, *Connecticut.

Streamflow and related surface-water data have been collected in Connecticut for more than 60 years. The data are transformed into information describing the variability and scientists. Streamflow is derived from direct precipitation on the State and from ranges from about 25 inches to 78 inches. The Connecticut River is the largest of the several streams entering the State, contributing an average annual inflow of 3,680 billion gallons. The three major stream systems draining the State--The Connecticut, Housantonic, and Thames Rivers--discharge an average of 6,200 billion gallons of freshwater into Long Island Sound each year. The average annual flow of the Housatonic River at Falls Village, the longest record, indicates no long-term trends over the past 68 years. However, they are distinct short-term streamflow variations in response to the distinct seasonal variations--highest monthly flows occur in April and the lowest in ranges from 0.9 to 1.4 million gallons per day per square mile (north-central and south-eastern Connecticut, respectively). The average annual streamflow for the entire State is 1.2 million gallons per day per square mile. Engineers and planners use peak-flow information for designing bridges and other structures and for defining flood-prone areas. Information on average and low flows is used for assessing impacts of waste-disposal practices, evaluating streams for water supply and recreation, and estimating the storage requirements for water supply. (USGS)
W83-00992

3F. Conservation In Agriculture

LOW-LEVEL AERIAL INFRARED IMAGES FOR INVENTORY OF AN IRRIGATED AREA,
Idaho Univ., Moscow. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 7B.
W83-00733

UTILITY OF FREQUENCY DISTRIBUTION OF MOISTURE ADEQUACY IN THE SELECTION OF CROPS FOR AREAS WITH MARGINAL RAINFALL,
Indian Agricultural Research Inst. (New Delhi).
U. S. Victor, C. V. S. Sastry, and P. S. N. Sastry.
Indian Journal of Agricultural Sciences, Vol 52, No 3, p 170-172, March, 1982. 3 Tab, 10 Ref.

Descriptors: *Moisture deficiency, *Crop yield, *Frequency distribution, Probability distribution, Frequency analysis, Mathematical studies, Groundnut, *India, Rainfall, Regional analysis, Semiarid lands, Semiarid climates, Climates, Arid lands, Moisture availability, Water stress, Irrigation, Water supply, Evapotranspiration.

The probability distribution of the moisture adequacy index in relation to groundnut with reference to its growth phases under the semi-arid conditions of the Delhi region was examined. Monthly potential evapotranspiration values were computed for the groundnut growing season, July-October, for 32 years. During germination and establishment brief dry spells of 6-10 days were more frequent. During the flowering and pod-development period a 6-10 day dry spell, indicating slight yield reduction, was more frequent and could be expected to occur in 7 out of 10 years. The top soil remained dry for 11-15 days consecutively in 5 out of 10 years during this phase. Moderate to disastrous soil drought and dry weather damage to groundnut production in this area could be expected in 4 out of 10 years. Groundnut production in the Delhi region could on the average be expected to suffer severe to total damage once in 4 years (25%). earlier studies showed that this crop suffered moisture stress when the actual evapotranspiration (AE) was less than 50% of the potential that is, the moisture adequacy index was less than 0.5, and potential conditions were attained when the index was greater than 0.9. The frequencies for these two threshold values during the crop-growing months from July through October showed that soil moisture in the root zone was adequate in 1-2 out of 10 years, during germination, establishment and early flowering phases, and once in 5 years during the pod development. During maturity, however, moisture inadequacy could be expected every alternate year. These findings indicate the frequency at which supplementary irrigation would be needed for optimum production. (Baker-FRC)
W83-00806

DAILY PATTERNS OF APPARENT PHOTOSYNTHESIS AND EVAPOTRANSPIRATION IN A DEVELOPING WINTER WHEAT CROP,
Kansas Agricultural Experiment Station, Manhattan. Evapotranspiration Lab.
For primary bibliographic entry see Field 2D.
W83-00823

WATER USE BY WHEAT AND PLANT INDICATORS OF AVAILABLE SOIL WATER,
Soil and Irrigation Research Inst. Pretoria (South Africa).
For primary bibliographic entry see Field 2I.
W83-00828

INFLUENCE OF IRRIGATION OF THE DEVELOPMENT AND YIELD OF POTATOES,
Warsaw Agriculture Academy (Poland). Inst. of Agricultural Foundations of Land Improvement.
J. Mosz, and P. Kowalik.
Agricultural Water Management, Vol 5, No 2, p 171-179, May, 1982. 4 Fig, 2 Tab, 17 Ref.

Descriptors: *Irrigation, *Crop yield, *Potatoes, Model studies, Irrigation patterns, Fertilization, Soil moisture, Water supply, Mathematical models.

An empirical verification is offered of the mathematical model for yields of potatoes grown under different water and fertilization conditions. Under determined water and fertilizer conditions, the yield of potatoes can be forecast by a theoretical model for potential yields. The applied regression equation has proved to give a high correlation between the measured tuber production and the calculated tuber yield. This is evident from the correlation coefficients reaching up to 0.96-0.97. The interpretation of the results of irrigation experiments by means of a mathematical model has appeared to be useful and reliable. (Baker-FRC)
W83-00833

MOISTURE-SENSITIVE GROWTH STAGES OF DWARF WHEAT AND OPTIMAL SEQUENCING OF EVAPOTRANSPIRATION DEFICITS,
Agronomy Journal, Vol 73, No 3, p 387-391, May-June, 1981. 4 Fig, 2 Tab, 17 Ref.

Descriptors: *Water deficit, *Growth stages, *Irrigation requirements, Soil-water-plant relationships, Water use efficiency, Irrigation efficiency, *Crop yield, *Wheat, *Evapotranspiration, Water stress, *India, Arid lands, Drought.

The moisture-sensitive growth stages of wheat (Triticum aestivum L., cultivar Kalyansona), grown in a coarse loamy soil, were quantified during 1971-75. Water, nitrogen application, and seeding rates were varied. No rain or groundwater reached the experimental site during the study. Irrigation was applied when the available soil water depletion reached + or - 70, 50, 40, 30%. One crop received no irrigation after planting. Nitrogen application were 0-300 kg N per ha, and seeding rates were 75-175 kg per ha. In order of decreasing sensitivity to water deficit the growth periods were booting/heading, flowering to grain development, and the vegetative stage. Without a prior evapotranspiration deficit in the vegetative stage, wheat yields were sensitive to water deficit during the booting/heading periods, but were relatively insensitive when the plants were conditioned to 15% moisture stress in the vegetative stage. Where water is limited, the deficits should be spread evenly over previous growth stages and the critical stage. In this regime the maximum water use efficiency occurred at an irrigation level lower than that of the maximum economic return point, about 17% yield reduction from maximum yield. Within the range of optimal evapotranspiration deficit the yield reduction vs. the evapotranspiration deficit relationship was linear with a slope of 1.29. This allows prediction of yield if maximum yield is known. (Cassar-FRC)
W83-00834

YIELD OF ALFALFA AND COTTON AS INFLUENCED BY IRRIGATION,
New Mexico State Univ., Las Cruces. Dept. of Agricultural Engineering.
T. W. Sammis.
Agronomy Journal, Vol 73, No 2, p 323-329, March-April, 1981. 3 Fig, 7 Tab, 22 Ref. OWRT A-063-NMEX.

Descriptors: *Evapotranspiration, *Water-production functions, *Irrigation requirements, *Alfalfa, *Cotton, Water use efficiency, Crop yield, *New Mexico, Soil moisture deficiency, Sprinkler irrigation, Soil-water-plant relationships.

Water-production functions, defined as the relationship between evapotransipiration and crop yield, were determined for cotton and alfalfa in New Mexico. Nonweighing lysimeter studies were conducted at 5 locations throughout the state in 1976-77 to measure yield and evapotranspiration under nonlimiting soil moisture conditions. Sprinkler line source studies were conducted only at Las Cruces in 1978-79 to define the water-production function in the range of limited water. A linear water-production function, transferable to any location in New Mexico, was observed for alfalfa. The function was statistically the same as alfalfa water-production functions for Nevada, Nebraska, and North Dakota. The value of this function, combined for the 4 states, was 8.3 cm water required to produce 1 ton per ha of alfalfa. However, the production function was different for different cuttings, the slopes (water use efficiency) varying from 0.09 to 0.18 per ton per ha per cm (higher for the last 2 of 5 cuttings). A linear water-production function was also observed for cotton but was applicable only to 2 areas in New Mexico. Results were significantly different from similar studies conducted in California. Water requirements were 0.07 and 0.03 cm for 1 kg per ha cotton in New Mexico and California respectively. These differences were caused by the fact that cotton yield is measured in lint and seed rather than total biomass. Although total biomass production of cotton may require the same amount of evapotranspiration in different sites, the production of lint and seed may vary in different locations. (Cassar-FRC)
W83-00836

AFTERNOON WATER DEFICITS AND GRAIN YIELDS IN OLD AND NEW SOYBEAN CULTIVARS,
Illinois Univ. at Urbana-Champaign. Dept. of Agriculture.
J. S. Boyer, R. R. Johnson, and S. G. Saupe.
Agronomy Journal, Vol 72, No 6, p 981-986, November-December, 1980. 7 Fig, 3 Tab, 15 Ref.

Descriptors: *Water deficit, *Crop yield, *Water potential, *Soybeans, Leaves, Root distribution, Soil-water-plant relationships.

Newer, higher-yield soybean cultivars had smaller water deficits at midday and greater root densities than older, lower-yield cultivars grown under the same conditions of adequate water during 3 seasons, 1975-77 in central Illinois. Grain yields (kg per ha) for the earlier maturing group were: Beeson (1968), 3744-4354; Harosoy (1951), 3549-3719: Hawkeye (1947), 3315-3843; and Richland (1938), 3290-3492. Grain yields (kg per ha) for the later maturing group were: Wayne (1964), 3423-4147; Ross, (1960), 3310-3988; Shelby (1958), 3317-3618; and Manchu (1911), 2760-2983. Average afternoon water deficits on a clear day (in bars) were: Beeson, 0.3-2.3; Harosoy, 1.1-2.6; Hawkeye, 1.0-2.9; Richland, 1.8-3.9; Wayne, 0.2-1.3; Ross, 0.6-3.6; Shelby, 0.4-1.7; and Manchu, 1.2-3.0. Data suggest that the older cultivars have yield-inhibiting water deficits at midday. Selective breeding for improved yield has coincidentally produced plants with better shoot water status during midday, perhaps as a result of increased root densities. (Cassar-FRC)
W83-00837

DROUGHT SENSITIVITY AT VARIOUS GROWTH STAGES OF BARLEY IN RELATION TO RELATIVE EVAPOTRANSPIRATION AND WATER STRESS,
Kongelige Veterinaer- og Landbohoejskole, Copenhagen (Denmark). Jordbrugsteknisk Inst.
V. O. Mogensen.
Agronomy Journal, Vol 72, No 6, p 1033-1038, November/December, 1980. 7 Fig, 2 Tab, 12 Ref.

Descriptors: *Water stress, *Growth stages, *Drought, *Barley, Water deficit, *Evapotranspiration, Irrigation effects, Irrigation requirements, Leaves, Water potential, Soil-water-plant relationships, *Crop yield.

Barley, grown in loamy sand in lysimeters near Copenhagen, Denmark, and protected from natural rainfall, was exposed to drought at different growth stages. Drought treatments consisted of single periods during which irrigation was withheld until all available soil moisture had been used. Droughts were imposed during the different growth stages: jointing, shooting, booting, heading, and grain formation. Relative evapotranspiration began to decrease when 2/3 of available soil moisture had been used. Drought sensitivity per stress day (relative evapotranspiration deficit times days of drought duration) was 0.14 during jointing (the most drought-sensitive growth stage), 0.08 during booting, and 0.038 after heading. Therefore, drought applied after heading produced 3.8% yield reduction per stress day. (Cassar-FRC)
W83-00838

A DEVICE FOR RAPID MEASUREMENT OF RATE OF FLOW FROM GATED IRRIGATION PIPE,
Agricultural Research and Extension Center, Amarillo, TX.
C. Regier.
Agronomy Journal, Vol 73, No 2, p 375-376, March-April, 1981. 3 Fig, 1 Tab.

Descriptors: *Flow measurement, *Irrigation, Furrow irrigation, Ettergate, Pipes, Gates, Uniform flow, Flow rates.

The Ettergate, a device for rapid determination of flow rate from a gate in an irrigation pipe, is described. It is constructed from a 3.8 liter rectangular metal can and a 0.45 kg coffee can. Water from the irrigation gate is allowed to flow into the top of the rectangular can and out of the attached coffee can at the bottom. Plastic lids calibrated for flow rates of 5 to 16 gallons per minute (holes approximately 2.2 to 4.1 cm in diameter) permit an estimation of the flow rates. The device may be used to adjust the irrigation pipe gates so that uniform flow reaches all furrows. (Cassar-FRC)
W83-00839

COMPARISON OF SPRINKLER, TRICKLE, SUBSURFACE, AND FURROW IRRIGATION METHODS FOR ROW CROPS,
New Mexico State Univ., Las Cruces. Dept. of Agricultural Engineering.
T. W. Sammis.
Agronomy Journal, Vol 72, No 5, p 701-704, September-October, 1980. 3 Tab, 7 Ref.

Descriptors: *Water use efficiency, *Irrigation efficiency, *Crop yield, Lettuce, Potatoes, Sprinkler irrigation, Trickle irrigation, Subsurface irrigation, Furrow irrigation, Las Cruces, *New Mexico.

The water use efficiency (WUE) and crop yield were compared for potatoes and lettuce in a study (1975-1977) using four types of irrigation: sprinkler, trickle, subsurface, and furrow. Crops were irrigated to maintain a soil water potential of -20 kPa or -60 kPa. Potatoes grown on clay loam soil in a dry region had the highest crop yield and WUE with subsurface irrigation applied when soil water potential at 15 cm depth reached -20 kPa. Potatoes grown on sandy loam soil in a region of more abundant rainfall had the highest WUE with trickle and subsurface irrigation applied when soil water potential at 15 cm depth reached -60 kPa. In this soil there were no significant differences in crop yields for the different irrigation methods. In general, potato size was not affected by irrigation treatment, but furrow irrigation produced a lower percentage of medium and large potatoes during some years. Lettuce, a shallow-rooted crop, produced good yields and WUE with any treatment supplying light, frequent irrigations: -20 kPa sprinkler and -20 and -60 kPa trickle or subsurface irrigation. Furrow irrigation produced similar yields and WUE except when used at germination time. The -60 kPa sprinkler treatment produced moisture stress and low yields. (Cassar-FRC)
W83-00840

EVAPOTRANSPIRATION STUDIES ON RICE IN RELATION TO WATER USE EFFICIENCY,
Agricultural Research and Education Center, Lake Alfred, FL.
S. F. Shih, G. S. Rahi, and D. S. Harrison.
Transactions of the ASAE, Vol 25, No 3, p 702-707, 712, May/June, 1982. 5 Fig, 2 Tab, 17 Ref.

Descriptors: *Evapotranspiration, *Water use efficiency, Consumptive use, Water use, *Lysimeters, *Rice, Seasonal variation, Crop yield, *Crop production.

Evapotranspiration (ET) of rice was measured in both lysimeter and field studies. Weekly and total ET requirements for rice production were compared in spring, summer, and fall seasons. The water use efficiency for rice production in the Evergaldes Agricultural Area (EAA) was computed, that is, the amount of water required to produce 1 kg of grain. The daily ET varied from 3.6 to 10.9 mm/day for a spring crop, from 3.3 to 11.7 mm.day for a summer crop, and from 1.8 to 7.6 mm per day for a fall crop. The mean daily ET values were 6.5, 6.8, and 4.5 mm/day for spring, summer and fall crops, respectively. Total ET varied from 740 to 880 mm, 610 to 840 mm, and 400 to 500 mm for spring, summer, and fall crops, respectively. The mean total ET values were 800, 740, 450 mm for spring, summer and fall crops, respectively. From 759 to 1150 kg with a mean of 875 kg of water was required to produce 1 kg of rough rice grain. (Baker-FRC)
W83-00868

EFFECTS OF REPEATED APPLICATION OF WATER STRESS ON WATER STATUS AND GROWTH OF WHEAT,
Duke Univ., Durham, NC. Dept. of Botany.
For primary bibliographic entry see Field 2I.
W83-00875

THE PERFORMANCE OF APPROPRIATIVE WATER RIGHTS SYSTEMS IN THE WESTERN UNITED STATES DURING DROUGHT,
Colorado Univ., Boulder. Dept. of Economics.
For primary bibliographic entry see Field 6E.
W83-00882

INCORPORATING CROP NEEDS INTO DRAINAGE SYSTEM DESIGN,
Texas A and M Univ., College Station. Dept. of Agricultural Engineering.
C. J. Ravelo, D. L. Reddell, E. A. Hiler, and R. W. Skaggs.
Transactions of the ASAE, Vol 25, No 3, p 623-629, 637, May/June, 1982. 8 Fig, 4 Tab, 28 Ref.

Descriptors: *Drainage, *Model studies, Mathematical models, Mathematical studies, Crop yield, Moisture availability, Water management, Agricultural watersheds, Crop production.

A rational approach was sought for incorporating crop drainage requirements into drainage design procedures. The overall design methodology must link crop drainage requirements, climatological data, and drainage theory into a workable design procedure. A crop response model was developed, based on the stress-day index concept. The stress-day index is the product of a stress-day factor and a crop susceptibility factors. Secondly, a stress-day factor was characterized as the area under the actual water table hydrograph above some critical water table level. The crop susceptibility factor was also characterized. Next the crop response model was incorporated into the water management model of Skaggs. Then a design methodology was developed through frequency analysis of simulation results from the modified water management model. Finally, a procedure was given for using the resulting design graphs for the day-to-day design of agricultural drainage systems. The overall approach provides a rational method for incorporating crop needs into drainage system desing. (Baker-FRC)
W83-00886

IRRIGATION SCHEDULING USING CROP CANOPY-AIR TEMPERATURE DIFFERENCE,
UOP Inc., St. Paul, MN. Johnson Div.
K. M. Geiser, D. C. Slack, E. R. Allred, and K. W. Stange.
Transactions of the ASAE, Vol 25, No 3, p 689-694, May/June, 1982. 2 Fig, 3 Tab, 31 Ref.

Descriptors: *Irrigation patterns, *Temperature effects, Model studies, Irrigation, *Corn, Crop yield, Humidity, Soil water, Soil moisture, Moisture avaiability, *Irrigation scheduling, *Minnesota.

A model was developed using temperature difference as the dependent variable to schedule irrigations. The model was tested by using it to schedule irrigations on corn in central Minnesota. The model was evaluated by comparing yields from plots scheduled by this method to those of unirrigated corn, corn on which irrigation has been scheduled by electric resistance blacks and an evapotranspiration (ET) model. The findings indicate that the equation as tested satisfactorily predicted when to irrigate the corn corp under conditions at the Becker, Minnesota Sand Plains Irrigation Research Farm. Yield for the temperature difference treatment was not significantly different from that of the resistance block and checkbook schedule treatments. Considerably less water was applied to the temperature differences treatment. It was concluded that the equation as developed satisfactorily predicted when to irrigate corn under the conditions in central Minnesota during the 1980 growing season. The canopy-air temeprature difference can thus be used to schedule irrigations. Using temperature differences as a scheduling criteria can reduce irrigation water application over other widely used methods. The need for radiation measurement may discourage adoption of the procedure by farmers. However, a possible alternative would be to have both net radiation and relative humidity broadcasts by local radio stations each afternoon. This would eliminate the need for the farmer to purchase and maintain equipment re-

quired for measurement of these factors. (Baker-FRC)
W83-00887

DRIP IRRIGATION LATERAL LINE NETWORK DESIGN,
Hawaii Univ., Honolulu. Dept. of Agricultural Engineering.
I. P. Wu, and H. M. Gitlin.
Transactions of the ASAE, Vol 25, No 3, p 675-685, May/June, 1982. 11 Fig, 11 Ref.

Descriptors: *Drip irrigation, *Network design, Slopes, Irrigation, Mathematical equations, Model studies, Pressure distribution, Flow friction, Friction, Flow measurement, Flow characteristics, Hydrodynamics, Flow.

A complete mathematical derivation of the double-inlet and the inflow-outflow systems is presented. Both the double-inlet and the inflow-outflow systems can achieve a much better unformity of water pressure (or emitter flow) along the lateral line than that of the single inlet system. Except at the condition where the dimensionless design parameter ranges from 0.5 to 1.5 (at or near optimal profile design), the pressure difference of a double-inlet or inflow-outflow lateral line system in only about one-third to one-fifth of the pressure difference caused by the single inlet system. The lateral line network system can be used for an area with larger variations of slopes because of the high uniformity of the water pressure which can be achieved by the system. The system can be designed by determining the location of the inlets on the lateral line based on the design criteria and the topographic conditions. The lateral line can be designed as straight lines disregarding the slope conditions of the field. In the design, a dimensionless design parameter, the ratio of the total energy gain by slope to the friction drop at the end of a single inlet lateral line, is used not only to classify the shape of the pressure profile of a single inlet system but also for designing the double-inlet and the inflow-outflow systems. (Baker-FRC)
W83-00888

EVALUATING INFILTRATION FOR BORDER IRRIGATION MODELS,
Science and Education Administration, Phoenix, AZ. Water Conservation Lab.
A. J. Clemmens.
Agricultural Water Management, Vol 5, No 2, p 159-170, May, 1982. 7 Fig, 2 Tab, 7 Ref.

Descriptors: *Infiltration, *Border irrigation, Irrigation, Seepage, Percolation, Leaching, Groundwater movement, Water management, Farming, Agricultural watersheds, Hydraulic models, Model studies, Runoff, Runoff rates, Agricultural runoff, Surface runoff.

A more reliable and flexible method is presented for determining infiltration in border strips when such information is collected. The method is called linear-station advance. A comparison between field data and the zero-inertia border irrigation model is made for advance, recession, runoff, and water depth hydrographs. The linear station advance did a good job of estimating the infiltration function for border strips. The method allowed for a better overall analysis of infiltration than previous methods. The result of the analysis is a series of points, each representing a volume balance, which can then be fit with any desired function. The results from the analysis were used as input to the zero-inertia border irrigation model. The model did an excellent job of predicting advance, recession, runoff (volume and rate) and water depths within the border. Therefore, even though this type of intensive data is extremely difficult to collect, reasonable results can be obtained from its analysis. The method will assist in the analysis of border irrigation hydraulics, from which improvement in irrigation water management will ultimately result. (Baker-FRC)
W83-01026

4. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control Of Water On The Surface

AGGREGATES OF PARTICULATE MATTER AND AUFWUCHS ON ELODEA CANADENSIS IN IRRIGATION WATERS, AND INACTIVATION OF DIQUAT,
Commonwealth Scientific and Industrial Research Organization, Griffith (Australia). Irrigation Research Lab.
K. H. Bowmer.
Australian Journal of Marine and Freshwater Research, Vol 33, No 3, p 589-593, 1982. 1 Fig, 1 Tab, 11 Ref.

Descriptors: *Herbicides, *Aquatic weed control, *Particulate matter, *Diquat, *Elodea canadensis, Weed control, Aufwuchs, Irrigation water, Macrophytes, Murray River, Murrumbidgee River, *Australia, Submerged plants, Adsorption, Fate of pollutants, Chemical interference.

The problem of herbicide inactivation by surface encrustations on aquatic weeds was studied with Elodea canadensis in the Murray and Murrumbidgee Rivers, Australia. The surface material is composed of inorganic clay colloidal material complexed with aufwuchs (epiphytic and filamentous algae, bacteria, and detritus). A solution containing 200 mg of the surface material suspended in water readily adsorbed diquat at the 1 mg per liter level. This adsorbing power is at least as great as that of seston, commonly found at concentrations of 100 mg per liter. Diquat can be an effective herbicide in this environment only if used at environmentally unacceptable levels. Other possible alternative herbicidal treatments are weakly basic chemicals, different formulations of diquat (oil, polymer, alginates, etc), or other chemicals. (Cassar-FRC)
W83-00741

SYNERGISTIC EFFECT OF GIBBERELLIC ACID AND CHLORFLURENOL ON 2,4-D WITH REGARD TO WATER HYACINTH,
Royal Tropical Inst., Amsterdam (Netherlands). Dept. of Agricultural Research.
A. H. Pieterse, and F. A. Roorda.
Aquatic Botany, Vol 13, No 1, p 69-72, 1982. 1 Tab, 15 Ref.

Descriptors: *Aquatic plants, Water resources development, *Water hyacinth, *2,4-D, *Gibberellic acid, Herbicides, Agricultural chemicals, Water pollution effects, Weed control, Weeds, Aquatic weeds.

More effective measures for controlling the growth and spread of water hyacinths with 2,4-D have been investigated. The plants were cultured in 1979 during the summer season in a heated greenhouse in concrete reservoirs filled with tap water, each containing 10 plants. The plants in different reservoirs were sprayed with 100 g/ha of 2,4-D together with 6 g/ha gibberellic acid (GA3), or either 22.5 or 45 g/ha chlorflurenol. Plants which were sprayed with 100 g/ha of 2,4-D were not affected and produced normal daughter plants similarly to the plants sprayed with water. Controls treated with 6 g/ha GA3 exhibited slight inhibition to growth and float formation. At the volume rate which is commonly used in the field (40 l/ha) there was a ten-fold enhancement of the 2,4-D effect when the herbicide was mixed with an extremely small amount of GA3. Plants sprayed with 100 g/ha 2,4-D and 45 g/ha chlorflurenol died within 3 weeks. The combination with 22.5 g/ha chlorflurenol was less potent, but the plants eventually died after 5 weeks. Treatment with chlorflurenol alone inhibited growth of young leaves but did not kill the plants. It is probable that apical dominance is affected, as the development of young leaves on the rhizome, which can be considered to be the main shoot, is inhibited. It may also be assumed that in the water hyacinth chlorflurenol brings about its effect via an inhibition of auxin transport. A decrease in 2,4-D concentrations needed will reduce the threat to nearby vegetation. (Baker-FRC)
W83-00745

PREDICTING THE EFFECTS OF DRAINAGE SYSTEMS ON CORN YIELDS,
S. Hardjoamidjojo, and R. W. Skaggs.
Agricultural Water Management, Vol 5, No 2, p 127-144, May, 1982. 6 Fig, 5 Tab, 20 Ref.

Descriptors: *Drainage systems, *Crop yields, *Corn, Water management, DRAINMOD, *Water stress, *Model studies, Surface drainage, Sand, Loam, Soil types, *North Carolina.

Stress day index (SDI) models were incorporated in the water management simulation model, DRAINMOD, to quantify the effect of soil water stresses on corn yield. The effects of a combination of excessive and deficient soil water conditions were approximated by a simple first-order crop response model where the relative overall yield (YR) equals the product of the relative yields due to excessive (YRw) and deficient (YRd) soil water conditions. A comparison was made between predicted and measured corn yields for 16 plot years of experimental data on the Tidewater Research Station near Plymouth, North Carolina, to determine the accuracy of the modified water management model. The predicted and measured results were in good agreement with the model describing 63% of the variation in yields for the 12-year period. A demonstration of the water management model was given through the simulated performance of several drainage system designs for a Portsmouth sandy loam soil. The results of the simulation demonstrated that a maximum long-term relative yield of 80% of the potential corn yield can be obtained with a drain spacing of 40 meters or less with good surface water conditions. The response of long-term average corn yields to surface drainage varied inversely with the intensity of subsurface drainage. The 25 year average yield for 100 meter spacing was only 47% of the potential yield when the surface drainage was poor as compared to 61% of the potential yield for good surface drainage. (Baker-FRC)
W83-00748

ON THE INTRODUCTION OF PHYTOPHAGOUS FISHES INTO GRAVITY-FLOW IRRIGATION SYSTEMS IN THE SUDAN,
Gezira Univ., Wad Medani (Sudan). Dept. of Biological Sciences.
T. A. Redding-Coates, and D. Coates.
Fisheries Management, Vol 12, No 3, p 89-99, 1981. 1 Tab, 47 Ref.

Descriptors: *Irrigation, *Fish, *Aquatic weed control, Sudan, Aquatic weeds, Aquatic plants, Water resources development, Water supply development, Water demand, Agriculture, Irrigation projects, Gravity flow, Irrigation canals, Water management, Human diseases, Public health.

Gravity-flow type irrigation schemes used in the Sudan are subject to economic and biological problems associated with the buildup of aquatic weeds. The Sudan is heavily dependent on irrigated agriculture. The largest and oldest of the irrigation schemes in the Sudan is the Gezira, which is also by far the largest single irrigated agricultural scheme of its type in the world. Water velocity varies between 0 and 1.0 m/s according to usage. Two species have been suggested as potential allies in the control of aquatic weeds in the Sudan. Attempts have been made to introduce the grass carp into the Sudan, and plans have been made to spend a considerable amount of money on this species, while the potential of the endemic Tilapia zillii is being ignored. The effect of phytophagous fishes on the abundance of water associated vectors of diseases is a very important consideration in tropical areas. Although theoretically beneficial effects of phytophagous fishes on the abundance of the vectors of malaria and schistomiasis would be expected, much research is needed in this area. Consideration should be given to the introduction of other species to control these vectors together with measures to control weeds biologically. An

integrated approach is needed to problems on the control of aquatic weeds and disease vectors. Phytophagous fishes undoubtedly have an important role to play in its area. Pesticides and herbicides used on the crops within the irrigated area should also be recognized as important parameters in such integrated control. (Baker-FRC)
W83-00783

A MODEL FOR THE DESIGN OF DRAINAGE IN FLAT AGRICULTURAL LANDS,
DHV Consulting Engineers, Amersfoort (Netherlands).
P. Minderhoud.
Agricultural Water Management, Vol 5, No 2, p 95-125, May, 1982. 10 Fig, 5 Tab, 5 Ref.

Descriptors: *Drainage, *Model studies, *Watersheds, Agricultural watersheds, Groundwater, Water table, Evapotranspiration, Soil moisture, Rainfall, Flood plains, Irrigation, Water management.

A computational model is presented that can be used to determine drainage measures and their costs. An essential part of this model is the simulation of surface runoff, evapotransiration, groundwater flow, groundwater level and soil moisture storage as a function of rainfall, potential evapotranspiration, physical soil properties and drainage measures. It has been elaborated for a wet tropical climate, for situations with open field drains, shallow groundwater table and a homogeneous soil underlain by an impervious layer. The land is flat and the proposed agricultural use requires control of the groundwater table. A basic element of the model is a scheme to compute the water balance per day for a drainage parcel. The water balance computation is performed for periods of 5-40 years of daily rainfall data, for a series of drainage intensities. The results can be subjected to a drainage criterion, from which a design drainage intensity and a corresponding drain spacing can be derived. The layout of canals for a block of 4 x 1 square kilometers is determined and excavation and a series of canal characteristics are computed. A summary of some applications is offered including agronomic studies of groundwater behavior in relation to drainage, studies of rainfall excesses in relation to design capacity of main drainage systems, and water balance studies. (Baker-FRC)
W83-00820

INFLUENCE OF POTASSIUM SOURCE (SEDIMENT VS. OPEN WATER) AND SEDIMENT COMPOSITION ON THE GROWTH AND NUTRITION OF A SUBMERSED FRESHWATER MACROPHYTE (HYDRILLA VERTICILLATA (L.F.)
Waterways Experiment Station, Vicksburg, MS.
For primary bibliographic entry see Field 2I.
W83-00830

DRAINAGE OF AN IRRIGATED SALINE SOIL IN ALBERTA,
Alberta Univ., Edmonton. Dept. of Soil Science.
D. R. Bennett, G. R. Webster, B. A. Paterson, and D. B. Harker.
Canadian Journal of Soil Science, Vol 62, No 2, p 387-396, May, 1982. 6 Fig, 3 Tab, 10 Ref.

Descriptors: *Irrigation practices, *Saline soils, Soil types, Salinity, Chemical properties, Irrigation, Crop production, Barley, Crop yield, Moisture availability, *Alberta, Canada, *Drainage, Water table.

The ability of a shallow subsurface drainage system to control the water table, reduce soil salinity and thereby improve crop yields in an irrigated, saline lacustrine basin near Magrath, Alberta, Canada was evaluated. The site had been recently restricted to use as a sheep pasture and had been out of crop production for 20 years due to moderate salinity and the presence of a water table within 0.3 meters of the surface. The area lies near the bottom of a bedrock ridge which rises 65 meters higher to the southwest at a distance of 6 km. Plastic corrugated tubing was installed in 1976 at depths of 1.1 to 1.5 meters and spacings of 15 and 30 meters in the saline soil. During the irrigation period, the water table rose to within 0.3 meters of the surface but was lowered to pre-irrigation levels within 48 hr. The water table was maintained at, or below, the depth of the drains between irrigations. The 15- and 30-meter spacings of the drain lines were equally effective in providing water table control in this lacustrine soil which was underlain by a coarse sand and gravel layer. Salinity levels were decreased substantially only within the surface 0.3 meter soil depth. Quality of the drainage effluent remained constant throughout the growing season with only small dilution effects detected during irrigations. Barley yields increased to 3900 kg/ha in 1978, 2 yr following drainage of this saline soil. (Baker-FRC)
W83-00850

FINITE ELEMENT MODEL TO DESCRIBE OVERLAND FLOW ON AN INFILTRATING WATERSHED,
Purdue Univ., Lafayette, IN. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 2E.
W83-00867

CREATION OF WETLAND HABITATS IN NORTHEASTERN ILLINOIS,
Resource Associates, Chicago, IL.
For primary bibliographic entry see Field 5G.
W83-00944

ENVIRONMENTAL EFFECTS OF RIVER CHANNEL WORKS USED IN LAND DRAINAGE IMPROVEMENT,
Liverpool Univ. (England). Dept. of Zoology.
For primary bibliographic entry see Field 6G.
W83-00952

4B. Groundwater Management

THE THERMAL SPRINGS OF BATH,
Bath Univ. (England). School of Chemistry.
For primary bibliographic entry see Field 2F.
W83-00755

EFFECT OF AN EPHEMERAL STREAM ON THE GROUNDWATER LEVEL AND GROUNDWATER QUALITY IN AN ARID ZONE OF INDIA,
Central Arid Zone Research Inst. Jodhpur (India).
K. N. K. Mrthy, and D. N. Bohra.
Journal of Hydrology, Vol 57, No 1/2, p 107-111, May, 1982. 3 Fig, 1 Ref.

Descriptors: *Groundwater level, *Groundwater management, *Water table fluctuations, Ephemeral streams, Rajasthan, *India, Water quality, Saline water, Streams, Water quality control, Conductivity, Wells, Irrigation water, Recharge, Groundwater recharge, Arid lands.

Wells on the active side of an ephemeral stream in the arid region of Jahore District, Rajasthan, India, produced water of better quality (conductivity 0.715-2.019 mS per cm) than more saline wells (conductivity, 1.614-17.458 mS per cm) on the inactive bank of the stream. Recharge was faster on the active side, as demonstrated by the differences in water levels, 2.35-5.88 m in wells on the active bank and 1.22-3.4 m in wells on the inactive bank. Wells closest to the banks on the active side had larger water level fluctuations and sweeter water than wells 0.5 km away from the banks. (Cassar-FRC)
W83-00897

A PHYSICAL MODEL STUDY OF THE STORAGE OF LOW-GRADE HEAT IN UNSATURATED CHALK,
Institute of Geological Sciences, Wallingford (England).
J. B. W. Day, J. H. Black, N. A. Chapman, and D. H. Hall.
Journal of Hydrology, Vol 56, No 1/2, p 61-83, March, 1982. 10 Fig, 7 Tab, 32 Ref.

Descriptors: *Heat transfer, *Waste heat, *Unsaturated flow, Heat storage, Heated water, Greenhouses, Cooling, Thermal capacity, Aquifer thermal energy storage, Permeability, Chalk, Conduction, Convection, Plumes, Percolation, Groundwater management.

The concept of unsaturated aquifer thermal energy storage (UATES) was tested on a pilot scale. This concept was developed to provide soil warming for a glasshouse by injecting waste hot water into a shallow, permeable, heat storing rock formation. In this study cylindrical tanks packed with chalk lumps were injected with 53C water. Temperatures in several locations within the tank and in a superposed greenhouse were measured during cooling periods up to 700 hours. For the process to be feasible the following factors must be favorable: (1) the percolation rate throughout the chalk unsaturated zone must be sufficient to accomodate the volume of water injected, (2) the heat exchange rate between hot water and chalk pore water should be high enough so that heat is not lost to the water table, (3) the heat anomaly produced should last at least 6 months, and (4) conduction and convection of heat toward the surface must be high enough to cause appreciable soil warming. Multiple inputs of hot water allowed faster uptake of heat than a single input. The pilot tests indicated that a thermal plume generated in the field would last throughout a winter season. The heat lost from the ground surface would raise the temperature in a glasshouse by a significant amount. (Cassar-FRC)
W83-00904

A NONLINEAR OPTIMISATION METHOD FOR AQUIFER PARAMETER ESTIMATION.
Roorkee Univ. (India). School of Hydrology.
For primary bibliographic entry see Field 2F.
W83-00905

NUMERICAL MODELING OF SALT-WATER INTRUSION IN THE NORTHERN GUAM LENS,
Guam Univ., Agana. Water and Energy Research Inst. of the Western Pacific.
D. N. Contractor, J. F. Ayers, and S. J. Winter.
Technical Report No 27, August 1981. 48 p, 34 Fig, 5 Tab, 10 Ref.

Descriptors: *Aquifers, *Coastal aquifers, *Aquifer management, *Recharge, *Pumping, *Hydrologic models, Groundwater storage, Natural recharge, Wells, Calibration, Water table fluctuations, Water resources development, Hydrologic data, Flow rates, Model studies.

Guam's economic growth and development depend on its available water resources. Pumping water from the northern Guam lens is a cost-effective way to increase supplies; but sea water intruding into the aquifer or contamination of the lens from sewage, industrial effluents, etc., can impair water quality. Also, for a safe yield, the equilibrium conditions after sustained pumping should not adversely affect the aquifer. This report studies the finite element theory and computer model used to solve groundwater problems, with specific application to the northern Guam lens. Hydrologic data for 1978 were assembled to calibrate the model using water elevation data from six wells; 1979 data were used for verification. The aquifer was divided into three regions and the permeability and porosity in each were variables in the calibration process. Steady-state runs were made with no pumping, 1978 pumping, twice 1978 pumping, and five times 1978 pumping. There were minor changes in water levels and aquifer volumes for the first three pumping rates, but major changes for the five-fold rate. A second run studied the effects of zero recharge to the aquifer in 1978. In dry months, water levels are controlled by sea level changes, and in wet months they respond to the recharge. A final management run concerned a sudden increase in pumping rate. The phreatic surface declines substantially at first, then slows to a much lower rate over a longer time. The interface moves more gradually over a much longer period. A measurement made of the location of the interface may be a result of flow

changes that occurred many months previously. This model could be useful in making numerous management and planning studies. (Atkins-Omniplan)
W83-00946

GROUNDWATER MANAGEMENT WITH PROCESS COMPUTERS IN THE HARDHOF GROUNDWATER PLANT OF ZURICH WATER SUPPLY,
Zurich Water Supply (Switzerland).
W. Gahler.
Aqua, No 5, p 0450-0454, 1982. 7 Fig.

Descriptors: *Groundwater management, *Water resources development, *Water supply, Management, Planning, Groundwater, Water pollution control, Computers, Monitoring, Groundwater levels, *Switzerland, Zurich.

Since 1933, Zurich Water Supply has produced drinking water from the groundwater system of the Limmat Valley. The amount of 56,000 cubic m/day was increased in 1949 to 70,000 cubic m/day. A recent expansion of the groundwater plant has been designed so as to increase extraction of drinking water without impairment to the groundwater conditions, which could only be effected by means of artificial groundwater enrichment. The groundwater stream has to receive the enrichment water in such a way that no polluted water from the City area can reach the drinking water collecting points. To manage the system the required overall view is obtained by the application of a process computer which registers and processes the on-line measured values of the groundwater levels. The reproduction of these conditions is mainly accomplished in the form of graphs. Isohypses maps of currents and stored situations can be reproduced within a few minutes. (Baker-FRC)
W83-01014

4C. Effects On Water Of Man's Non-Water Activities

VARIABLE EFFECTS OF SEDIMENT ADDITION ON STREAM BENTHOS,
North Carolina Div. of Environmental Management, Raleigh.
D. R. Lenat, D. L. Penrose, and K. W. Eagleson.
Hydrobiologia, Vol 79, No 2, p 187-194, 1981. 4 Fig, 6 Tab, 32 Ref.

Descriptors: *Streams, *Benthos, *Road construction, *Sedimentation, Construction, Roads, Benthic environment, Warrior Creek, Spainhour Creek, Sand, Population density, Macroinvertebrates, *North Carolina.

The effects of road construction, especially as concerns sediment input, were studied using two upper Piedmont streams as the study site. Spainhour Creek and Warrior Creek are located in Caldwell County, North Carolina, north of Lenoir. Both cross NC 321 in an area where the road is being widened from two to four lanes. These streams are located in agricultural areas and receive surface runoff from farmland and rural dirt roads. Stream benthos were collected by the 'kick' method. Two samples were collected at each of three sampling stations, usually at a depth of 20 cm. Station 1 was above the construction site and served as a control. Stations 2 and 3 were located at or just below the construction, respectively. Data suggests that sediment additions can affect the benthic community in two ways. The reaction of the benthic community is dependent on the stability of sand substrates which is, in turn, dependent on flow. During low flow conditions a stable-sand community develops which differs qualitatively from the community associated with rocky substrates. The stable sand community is composed of small grazing organisms capable of rapid colonization and reproduction. The average density of this community may exceed the density of benthic organisms at control areas. During high periods sand substrates are an unsuitable habitat for all benthic organisms. The effect of sediment addition is simply to reduce available habitat area. The remaining community is qualitatively similar to that of unstressed areas, but has a markedly lower density. Any reductions in species richness are primarily an artifact of reduced sample size. (Baker-FRC)
W83-00730

HYDROLOGIC EFFECTS OF HIGHWAY-DEICING CHEMICALS IN MASSACHUSETTS--EXECUTIVE SUMMARY,
Geological Survey, Boston, MA. Water Resources Div.
L. R. Frost, Jr., S. J. Pollock, and R. F. Wakelee.
Available from OFSS, USGS Box 25425, Fed. Ctr. Denver, CO 80225. Paper copy $1.50, Microfiche $3.50. Geological Survey Open-File Report 81-210, 1981. 10 p, 1 Fig, 4 Tab, 10 Ref.

Descriptors: *Highways, *Deicers, *Sodium chloride, *Surface runoff, *Water quality, Path of pollutants, Infiltration, Solute transport, Drainage systems, Flow separation, Groundwater recharge, Specific conductivity, Data collections, Hydrologic models, Regression analysis, *Massachusetts, Highway deicing chemicals.

Methods of estimating annual mean and annual maximum chloride concentrations in streams were developed through multiple and simple linear regression techniques using data collected during the 1972-77 water years. Independent variables are easily obtainable parameters, such as total salt application within a basin, annual precipitation, and drainage basin characteristics. Methods for obtaining gross estimates of chloride loads and sodium loads from salt-application data and estimates of nonhighway-related chloride and sodium were suggested. A chloride budget was calculated for a small basin draining a section of interstate highway. The chloride budget was described in terms of the percentages in direct runoff to the stream, in ground-water discharges to the stream, in storage in the ground, and the amount unaccounted for. Attempts were made to relate chloride concentrations in ground water adjacent to highways to quantities of salt applied to the highways on an annual basis, annual precipitation, depth of the wells below land surface, depth of the well below water table, and the distance of the well from the edge of the pavement. Little correlation was observed between annual salt-application values and annual mean chloride concentrations in ground water near highways. The irregular distribution of highway runoff, due to topographic differences between sites, and variations in runoff resulting from individual storms seem to be the causes of the lack of significant correlation between annual quantities of salt applied and chloride concentrations in ground water near highways. (USGS)
W83-01008

4D. Watershed Protection

SOIL EROSION AND RUNOFF FROM PLANTING TO CANOPY DEVELOPMENT AS INFLUENCED BY TRACTOR WHEEL-TRAFFIC,
Science and Education Administration, Morris, MN.
R. A. Young, and W. B. Voorhees.
Transactions of the ASAE, Vol 25, No 3, p 708-712, May/June, 1982. 6 Fig, 2 Tab, 19 Ref.

Descriptors: *Erosion control, *Soil management, *Runoff, Rainfall, Farming, Farms, Farm management, Farm equipment, Agriculture, Soil erosion, Soil mechanics, Soil engineering, Erosion, Soil conservation, Conservation, Slope protection, Slope, Soil aggregates, Soil compaction, Compaction, Soil density, Density, Soil properties, Porosity, Soil porosity.

Wheel traffic effects on erosion and runoff were studied during the critical erosion period occurring after planting. A rainfall simulator was used to apply known amounts of rainfall energy in late May and early June of 1979 to 12 field plots on land at the West Central Experiment Station. The soil is a Barnes loam with a 6% slope. All wheel traffic from all farming operations was controlled to occur in the same path in each plot over a 2 year period prior to making the rainfall runs. All wheel traffic was up and down slope, a standard practice on small runoff plots. Wheel tracks were 45.7 cm wide, spaced 150 cm apart, and centered on the plot. Simulated rainfall was applied at the rate of 6.35 cm/hr for four 1.2 hr increments. The first two increments were separated by 15 min, and the second and third by 1 hr. The third and fourth increments were separated by 15 min. Soil compaction as a result of wheel traffic affects several soil properties which in turn can have a significant effect on infiltration and runoff and subsequent patterns of erosion. Compaction in this study increased bulk density and decreased total porosity of the tilled layer significantly, both of which reduced infiltration and increased runoff and soil loss. Soil moisture at time of tillage was low enough so that any compensating effects of compaction on aggregate stability, random roughness and matric potential were minimized, thus leaving the wheel track areas in a more erodible condition than the nontracked areas. These findings emphasize the need to manage wheel traffic to reduce runoff and erosion. (Baker-FRC)
W83-00889

5. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification Of Pollutants

BIOTIC INDEX TESTED FOR ABILITY TO ASSESS WATER QUALITY OF MISSOURI OZARK STREAMS,
Missouri Univ. - Columbia. School of Forestry, Fisheries and Wildlife.
J. R. Jones, B. H. Tracy, J. L. Sebaugh, D. H. Hazelwood, and M. M. Smart.
Transactions of the American Fisheries Society, Vol 110, No 5, p 627-637, September, 1981. 7 Tab, 30 Ref.

Descriptors: *Water quality, *Aquatic life, Benthos, Streams, Ozark Mountains, Insects, *Missouri, White River, Gasconade River, River basins, *Bioindicators.

Fifteen samples of the aquatic insect community were collected between 1 June and 19 December, 1978 at each of 11 study sites in 8 streams in the White and Basconade River basins in southwest and south-central Missouri. The Biotic Index (BI), a numerical index that combines the pollution tolerance of benthic insects with estimates of community structure, effectively discriminated among differences in the macroinvertebrate assemblages. The BI at a given site is affected by spatial and temporal differences in the benthic community but not by species that occur in only small numbers. Six kick-net samples provided sufficient data for estimating an average BI value, and for detecting statistically significant differences in the values between two sites. Differences in the BI among sampling sites were supported by differences in the taxonomic composition of the benthic communities and were statistically related to stream water chemistry. The BI was more sensitive and less variable than diversity indices for discriminating differences in stream water quality. (Baker-FRC)
W83-00728

A METHOD FOR THE EVALUATION OF EFFLUENT QUALITY OF VARIOUS MECHANICAL PULPING PROCESSES,
Paprican, Point-Claire (Quebec).
A. Wong, D. Breck, J. Constantino, J. Wearing, and D. A. Holder.
Pulp and Paper Canada, Vol 82, No 10, p 65-70, October, 1981. 3 Fig, 5 Tab, 13 Ref.

Descriptors: *Pulp and paper industry, *Pollutant load, Water quality, Pollutant identification, Biological oxygen demand.

A procedure for predicting pollutant discharges for the thermomechanical pulping (TMP) process and stone groundwood (SGW) pulp process was based on single-stage washing of the pulp under

controlled laboratory conditions. The pollutants removed from the fibers may be used to test for fish toxicity or other chemical tests and to calculate the pollutant load to the receiving waters. The washing procedure for TMP was standardized at 60 + or - 5C and 60 min. For SGW it was necessary to use a mass balance approach: BOD in drained liquid of original grinder pit stock + BOD in wash filtrate of grinder pit stock - BOD in mill white water to grinder showers = net BOD from SGW process. (Cassar-FRC)
W83-00750

A COMPARISON STUDY FOR DETERMINING DISSOLVED BORON IN NATURAL WATER AND GEOTHERMAL FLUID,
Los Alamos National Lab., NM.
P. E. Trujillo, E. Gladney, D. A. Counce, E. J. Mroz, and D. R. Perrin.
Analytical Letters, Vol 15, No 7, p 643-655, 1982. 3 Tab, 35 Ref.

Descriptors: *Water analysis, *Boron, *Geothermal studies, Chemical analysis, Pollutant identification, *Spectroscopy, *Colorimetry, Natural waters, Chemical composition.

Reference samples, geothermal fluids, and natural water samples were analyzed for boron using several methods: three colorimetric methods (carmine and two azomethine H), two plasma emission spectroscopy methods (D.C. argon and inductively coupled argon), and thermal neutron capture-gamma spectroscopy. Results were acceptable and comparable. However, each method had its own distinct advantages and disadvantages. Colorimetric methods, especially the azomethine H method, were most suitable for field use. Emission spectroscopy methods were relatively easy to analyze and very accurate, but required expensive instrumentation available only in a laboratory. The capture gamma ray method was highly accurate, but is limited to a facility having a nuclear reactor. (Cassar-FRC)
W83-00761

SPECTROPHOTOMETRIC DETERMINATION OF MICROGRAM AMOUNTS OF CHROMIUM(VI) AND TOTAL CHROMIUM IN WASTE WATER,
China Univ. of Science and Technology, Hefei. Dept. of Chemistry.
F. S. Wei, Y. R. Zhu, P. H. Qu, F. Yin, and N. K. Shen.
Mikrochimica Acta, Vol 2, No 1/2, p 67-75, 1982. 4 Fig, 3 Tab, 23 Ref.

Descriptors: *Chromium, *Wastewater analysis, *Industrial wastewater, Pollutant identification, Electroplating, *Spectrophotometry.

A procedure for determination of Cr(3+) in wastewater is based on measuring the absorbance of the dark blue-purple complex formed with 2-(5-Bromo-2-pyridyl)-5-diethylaminophenol. The general procedure involves heating the sample solution at 100-105C for 20-60 min with the reagent buffered to pH 4.7. After color development, the mixture is cooled to room temperature and the reaction product is dissolved with ethanol. Absorbance is measured at 600 nm. To determine Cr(6+) in electroplating wastewater, the interfering ions (trivalent Cr and divalent Co, Ni, and Cu) are first precipitated by addition of ferric chloride solution. Total Cr tri-and hexavalent may be determined in an industrial wastewater by developing the colored complex and removing undesired substances by chloroform extraction. Sandell sensitivity of the method is 0.00065 micrograms Cr(3+) per sq cm. At an average Cr content of 0.60 ppm, the standard deviation is + or - 0.015, and the coefficient of variation is 2.5%. Recoveries of Cr from 10 ml samples spiked with 5 and 10 micrograms Cr were greater than 95%. (Cassar-FRC)
W83-00768

APPLICATION OF MULTIPLE DISCRIMINANT ANALYSIS ON THE ANALYSIS OF THE CORRELATION BETWEEN MACROPHYTE VEGETATION AND WATER QUALITY IN RUNNING WATERS OF CENTRAL EUROPE,
Oldenburg Univ. (Germany, F.R.).
G. Wiegleb.
Hydrobiologia, Vol 79, No 1, p 91-100, 1981. 1 Fig, 4 Tab, 44 Ref.

Descriptors: *Water quality, *Statistical analysis, *Macrophytes, Vegetation, *Europe, Streams, Rivers, Multiple discriminant analysis, Prediction, Running waters, Lotic environment.

A total of 124 sections of watercourses from Northwest Germany and 154 sections of watercourses from Southern Germany were classified into ten groups with regard to water quality and physico-chemical water type. Vegetation data were transformed into a two-step scale. Using the 39 most frequent water plant species as predictor variables, a stepwise multiple discriminant analysis was performed. Twenty-nine species proved to be suitable for optimal discrimination of the groups. Most of the species correspond to those to which a certain indicator value had already been adjudged, using other methods. Species number, which was also tested, was not taken into the analyses. The score of right predictions ranged between 70 and 85%, depending on the technique of the analysis and the number of data. Totally wrong predictions with regard to water quality as well as to water type were infrequent. Some possibilities for an explanation of mispredictions were suggested with respect to the fact that a statistical model will never immediately indicate changes in the investigated system. Finally, an ordination of the groups was carried out. The position of the groups in the canonical discriminant space could partly be interpreted in terms of succession. (Baker-FRC)
W83-00776

GAS CHROMATOGRAPHIC ANALYSIS OF TRACE HYDROCARBON POLLUTANTS IN WATER SAMPLES,
Brunel Univ., Uxbridge (England). School of Chemistry.
B. A. Colenutt, and S. Thorburn.
International Journal of Environmental Studies, Vol 15, No 1, p 25-32, 1980. 4 Fig, 5 Tab, 10 Ref.

Descriptors: *Hydrocarbons, *Air pollution, *Trace levels, *Pollutant identification, Aromatic hydrocarbons, Aliphatic hydrocarbons, Alkanes, Organic compounds, *Gas chromatography, Sample concentration, Water analysis, Water pollution sources, Fate of pollutants.

Selected hydrocarbons present in water samples at the parts per billion level were concentrated by a stripping technique. The procedure used purified nitrogen gas bubbled through 1-5 liters of water sample at flow rates up to 1 liter per min. The trap for the organic compounds was a 80 mm long silica glass tube filled with 100-120 mesh activated carbon. Compounds adsorbed on the trap material were desorbed with carbon disulfide. Concentrated hydrocarbons were then analyzed by gas chromatography, with confirmation of peak identity by gas chromatography-mass spectroscopy. Hydrocarbons (n-alkanes from n-octane to n-hexadecane, benzene, toluene, ethyl benzene, and xylene) were found in water samples collected from lakes and brooks. In waters impacted by motor boats or highway traffic the hydrocarbon levels reached up to 18.6 ppb for a single constituent. Water bodies more remote from obvious hydrocarbon sources contained up to 7 ppb of a single consituent. Hydrocarbons in air samples were about 10 fold higher than in water samples. Atmospheric washout was the source of hydrocarbons in the water, as shown by measurements of hydrocarbons in air, rain water, and lake-creek samples before and after rain. (Cassar-FRC)
W83-00800

DETERMINATION OF SULPHIDE ION AT TRACE LEVELS BY ETHYLATION AND GAS CHROMATOGRAPHY,
Osaka Univ. (Japan). Dept. of Applied Chemistry.
K. Funazo, T. Hirashima, M. Tanaka, and T. Shono.
Fresenius' Zeitschrift fuer Analytische Chemie, Vol 311, No 1, p 27-29, 1982. 3 Fig, 2 Tab, 4 Ref.

Descriptors: *Water analysis, *Sulfides, *Pollutant identification, Chromatography, Sulfates, Spring waters, Natural waters, *Ethylation, *Gas chromatography.

The determination of sulfide by ethylation with diethyl sulfate and gas chromatography with a flame ionization detector (FID) or a flame photometric detector (FPD) is described. In the case of the FPD the detection limit for sulfide ion is 0.05 microg/ml. Other anions commonly found by this method and for comparison also by colorimetry (methylene blue). The results revealed the reliability of the new method. The methylene blue method is subject to interference by anions such as F(-), N02(-), and S03(-2). (Baker-FRC)
W83-00805

DETERMINATION OF TRACE LEVELS OF QUATERNARY AMMONIUM COMPOUNDS IN RIVER WATER BY LIQUID CHROMATOGRAPHY WITH CONDUCTOMETRIC DETECTION,
Procter and Gamble Co., Cincinnati, OH.
V. T. Wee, and J. M. Kennedy.
Analytical Chemistry, Vol 54, No 9, p 1631-1633, August, 1982. 4 Fig, 1 Tab, 16 Ref.

Descriptors: *Quaternary ammonium compounds, *Pollutant identification, *Wastewater, Industrial wastewater, Rivers, Water pollution sources, *Chromatography, High pressure liquid chromatography.

As ingredients in consumer products, quaternary ammonium compounds are generally discharged to surface waters via wastewater treatment plants. A new analytical procedure is presented for the quantitation of both UV-absorbing and non-UV-absorbing quaternaries. The procedure includes a simple and efficient scheme to extract the quaternary ammonium compound from the river water matrix. The extracted quaternary compounds are separated and quantified by using high-performance liquid chromatography with a conductivity detector. The unique feature of the method is the chromatographic system. For the first time, non-UV-absorbing long alkyl chain quaternaries are determined at submicrogram levels without any form of derivatization. In addition, ion chromatography is performed in a nonaqueous medium, without ion paring, and in the absence of a suppressor column. The new method was successfully used to determine two non-UV-absorbing quaternaries, ditallowdimethylammonium chloride and dodecyltrimethylammonium chloride, and two UV-absorbing quaternaries, stearyldimethylbenzylammonium chloride and 1-hexadecylpyridinium chloride, is several river waters. The concentrations of the quaternaries were all in the low parts per billion concentration, ranging from 5 to 30 ppb for ditallowdimethylammonium chloride and less than 2 ppb for the other compounds. (Baker-FRC)
W83-00841

FREE NICKEL ION CONCENTRATION IN SEWAGE BY AN ION EXCHANGE COLUMN-EQUILIBRATION METHOD,
Alberta Univ., Edmonton. Dept. of Chemistry.
F. F. Cantwell, J. S. Nielsen, and S. E. Hrudey.
Analytical Chemistry, Vol 54, No 9, p 1498-1503, August, 1982. 1 Fig, 2 Tab, 52 Ref.

Descriptors: *Nickel, *Pollutant identification, *Wastewater, Metals, Heavy metals, Speciation, *Ion studies, Ion exchange, Equilibration,.

The theory and the experimental method for determining free nickel (II) concentrations by both a batch technique and a new column equilibration technique are considered. The methods were tested on model systems; the column technique was used to measure Ni(++) concentration in municipal sewage. The column method was verified on synthetic solutions containing free nickel concentrations in the range of 10 to the minus 6th and 10 to the minus 7th power M with EDTA and glycyl-L-alanine as ligands. Batch methods should be performed with several weights of resin to compensate for perturbation of the equilibria, while the column method is nonperturbing. Seven grab sam-

ples of sewage were analyzed for total nickel before and after centrifugation and were analyzed by the column method for free nickel Ni(++). About half the total nickel was contained in particulate matter that sediments when centrifuged at 14,000 x G, and the remainder is 'soluble'. In six of the samples Ni(++) was present at less than 5 x 10 to the minus 9th power M, and in the seventh the Ni(++) concentration was about 1 ppb, representing about 3% of the total 'soluble' nickel. This suggests that sewage contained a high concentration of ligand(s) and/or very strong ligand(s). Titration of sewage with nickel(II) revealed a complexing capacity of about 0.00001 M. (Baker-FRC)
W83-00842

METHODS OF ANALYZING QUINONES IN WATER AND THEIR APPLICATION IN STUDYING THE EFFECTS OF HYDROPHYTES ON PHENOLS. PART 2: POLAROGRAPHIC METHODS OF QUINONE ANALYSIS,
Irkutskii Gosudarstvennyi Univ. (USSR). Scientific Research Inst. of Biology.
D. J. Stom, S. S. Timofeeva, N. F. Kashina, L. J. Bielykh, and S. N. Souslov.
Acta Hydrochimica et Hydrobiologica, Vol 8, No 3, p 213-221, 1980. 3 Fig, 10 Tab, 4 Ref.

Descriptors: *Quinones, *Polarographic analysis, *Phenols, *Pollutants identification, Aromatic compounds, Organic compounds, Water analysis, Pulp and paper industry.

Quinones in water were determined by an oscillopolarographic method. The apparatus had a three-electrode cell that permitted operation under the conditions of a driven sweep without bottom mercury. A saturated calomel electrode served as a comparison electrode. Measurements were carried out at 19.0 + or - 0.5C and at the polarization volatage charge rate of 1 V per sec. Standard samples of 1,4- and 1,2-benzoquinone, 4-methyl-1,2-benzoquinone, 1,2-chloranil, and chloranilic acid added at 7.9-30.6 mg, analyzed by the oscillopolarographic method, showed good recovery: relative error 3%. Several types of pulp mill effluents were also analyzed. Total quainone concentrations were 0.23-2.25 mg per liter. (Cassar-FRC)
W83-00864

METHODS OF ANALYZING QUIONES IN WATER AND THEIR APPLICATION IN STUDYING THE EFFECTS OF HYDROPHYTES ON PHENOLS. PART 1: QUINONE DETERMINATION WITH BENZENE SULFINIC ACID,
Irkutskii Gosudarstvennyi Univ. (USSR). Scientific Research Inst. of Biology.
D. J. Stom, S. S. Timofeeva, N. F. Kashina, L. J. Bielykh, and S. N. Souslov.
Acta Hydrochimica et Hydrobiologica, Vol 8, No 3, p 203-211, 1980. 4 Fig, 7 Tab, 9 Ref.

Descriptors: *Quiones, *Phenols, *Pollutant identification, *Aromatic compounds, Organic compounds, Water analysis, Benzene sulfinic acid, *Chromatography.

A method for determining quinones in water is based on thin layer chromatographic analysis of compounds formed by reaction of quinones with benzene sulfinic acid. The sulfonyl compounds are extracted with n-butyl acetate and quantified by spectrophotometer. Two pairs of mixtures were tested: pyrocatechol, 4-phenyl sulfinyl pyrocatechol: and hydroquinone, 2-phyenyl sufonyl hydrogquinone. Initial concentrations were on the order of 0.0015 to 0.00005 M. These chemicals were detected in the range 5-80 micrograms. (Cassar-FRC)
W83-00865

A SIPHON DEVICE FOR FRACTIONATION OF RUNOFF SAMPLES,
Canterbury Univ., Christchurch (New Zealand). Dept. of Chemistry.
For primary bibliographic entry see Field 7B.
W83-00884

LARGE BORE COATED COLUMNS IN ANALYSIS FOR TRACE ORGANIC POLLUTANTS IN WATER,
Life Savers, Inc., Port Chester, NY.
M. M. Hussein, and D. A. M. Mackay.
Journal of Chromatography, Vol 243, No 1, p 43-50, July, 1982. 3 Fig, 4 Tab, 9 Ref.

Descriptors: *Pollutant identification, *Water analysis, *Organic compounds, Large bore coated columns, Chromatography, Benzene, Naphthalene, o-Cresol, Dibenzyl, Fluorene, Dodecane, Sample preparation.

The application of large bore coated (LBC) columns in water pollution analysis is described, wherein they are used as traps for the trace organics. Model pollutants representing various classes of chemicals were used in the analyses, including benzene, dodecane, naphthalene, o-cresol, dibenzyl and fluorene. The LBC column serves to concentrate trace organics from water simply by passing a sample of water through this device. The trapped organics are then thermally desorbed onto a short porous polymer or charcoal pre-column. After the residual moisture is driven off, the trapped material is eluted onto the analytical gas chromatographic column and analyzed under programmed temperature conditions. The chemicals used were examined in concentrations between 50 ppb and 5 ppm. Only 20 ml of sample was needed for analysis. Manipulation of sample volume and number of passes through the LBC column resulted in good quantitative recovery for most of the chemicals, except benzene, for which recovery was poor. The LBC column coated with SE-30 showed different retention efficiencies for each compound at different concentrations. The lowest concentration gave best recoveries. The polynuclear compounds gave particularly good results, and quantitative recoveries of these compounds were possible at the 50 ppb level. The results obtained with the LBC column compared favorably with those obtained by headspace nitrogen sparging or solvent extraction. (Baker-FRC)
W83-00963

EVALUATION OF FACTORS AFFECTING THE MEMBRANE FILTER TECHNIQUE FOR TESTING DRINKING WATER,
Michigan Dept. of Public Health, Lansing. Bureau of Disease Control and Lab. Services.
S. C. Hsu, and T. J. Williams.
Applied and Environmental Microbiology, Vol 44, No 2, p 453-460, August, 1982. 3 Fig, 7 Tab, 7 Ref.

Descriptors: *Bacterial analysis, *Coliforms, *Membrane filters, *Drinking water, *Water analysis, Pollutant identification, Most probably number test, Sample preservation, Microbiological studies, Culture media, Agar.

The membrane filter (MF) technique for determining total coliforms in drinking water was compared with the most probable number (MPN) technique. Several factors affecting MF results were also evaluated. The MF procedure using m-Endo agar LES was somewhat superior to the MPN method in comparisons of 1346 analyses. Results from the two methods agreed in 93.8% of the samples, MPN gave better results in 1.1%, and MF gave better results in 5.1%. Studies confirmed that m-Endo agar LES was heat and light sensitive. The agar should be rehydrated in boiling water for no more than 15 min and not exposed to light for more than 4 hours. Agar plates may be stored for up to 4 weeks and broth verification media for up to 3 weeks if refrigerated in sealed plastic bags. Atypical colonies which did not produce sheen as expected for coliforms but did give positive brilliant green bile (BGB) broth verification test results were studied. It was recommended that lauryl tryptose enrichment prior to BGB verification be eliminated. The 5-20% of specimens showing overgrowth were decreased 7% by directly inoculating the BGB medium with the swab from the MF plate. Overgrowth was greater in samples, especially swimming pool water, held for extended periods. A 5% per 24 hour increase in overgrowth was seen in stored drinking water samples. Although a complex combination of factors affects storage of coliform strains, it is generally safe to keep a sample up to 72 hours. (Cassar-FRC)
W83-01019

SPECTROPHOTOMETRIC DETERMINATION OF SULPHIDE IN WATER BY RE-EXTRACTION AND LIGAND EXCHANGE USING CHLOROFORM SOLUTIONS OF COPPER QUINOLIN-8-OLATE,
Extremadura Univ., Badajoz (Spain). Dept. of Analytical Chemistry.
M. Roman Ceba, F. Vinagre Jara, and J. A. Munoz Leyva.
Analyst, Vol 107, No 1276, p 781-786, July, 1982. 1 Fig, 4 Tab, 8 Ref.

Descriptors: *Sulfide, *Water analysis, *Pollutant identification, Sulfur compounds, Extraction, *Spectrophotometry, Copper quinolin-8-olate, Chelating agents.

A simple, rapid, sensitive and selective method for assaying sulfide in water is based on measuring decoloration produced in chloroform solutions of copper quinolin-8-olate. After pH adjustment to 4.5-8.0 the sample is shaken for 6 min with a chloroform solution of copper quinolin-8-olate (60 mg per liter). The organic layer is transferred into a flask containing anhydrous sodium sulfate. To provide a blank a sulfide-free water sample is treated similarly. The differences between the spectrophotometric readings at 410 nm are the decoloration values which are compared with calibration graphs. The highly selective method can determine sulfide in the presence of other sulfur compounds. Relative error of the procedure is 2%. A sample of river water spiked with sulfide produced results which agreed with the methylene blue method in the range 0.5-1.0 micrograms per ml and were lower than the methylene blue method at concentrations higher than 1 microgram per ml. (Cassar-FRC)
W83-01036

5B. Sources Of Pollution

DISTRIBUTION OF HEAVY METALS IN BOTTOM MUD OF RIVERS VIII. DISTRIBUTION OF TOTAL AND EXTRACTABLE CD AND ZN,
Tasaki Coll. of Economics, Gumma (Japan).
F. Tada, and S. Suzuki.
Japanese Journal of Limnology, Vol 42, No 3, p 160-167, July, 1981. 6 Fig, 6 Tab, 18 Ref.

Descriptors: *Bottom sediments, *Rivers, *Metals, Cadmium, Zinc, Chemical analysis, Mud, Aquatic soils, Sediments, Sedimentation, Water analysis, *Japan.

Bottom mud from Japanese rivers of the first category was analyzed for total and extractable cadmium and zinc content. The upstream mud contained 0.00-2.02 ppm total cadmium, and about 90% of the mud samples showed the amount of cadmium to be below 1.00 ppm. The average Cd content was 0.46 ppm. The total Cd in downstream mud was distributed over a wide range, and its maximum value was 6.89 ppm. The content of Cd in 12% of the downstream mud samples was higher than 2.00 ppm, and the average Cd content was 1.39 ppm, which was three times higher than that of the upstream mud. The distribution of total zinc was in the range of 13-223 ppm and the average was 72.2 ppm in the upstream bottom mud. These data indicate that the total Cd and Zn amounts in upstream bottom mud are close to those found in non-polluted soils and they are assessed as being at the natural level. Total cadmium and zinc in the downstream area are two to three times higher than the levels in upstream mud. The average contents of zinc and cadmium were 244.7 and 1.86 ppm respectively in mud polluted with organic matter, which is remarkably higher than the upstream mud level. (Baker-FRC)
W83-00719

STUDIES ON THE DECOMPOSITIVE PROCESSES OF PHYTOPLANKTONIC ORGANIC MATTER,

Nagoya Univ. (Japan). Water Research Inst.
For primary bibliographic entry see Field 2H.
W83-00720

THE DISTRIBUTION OF UREA IN LAKE YUNOKO,
Tokyo Metropolitan Univ. (Japan). Dept. of Chemistry.
Y. Satoh, and T. Hanya.
Japanese Journal of Limnology, Vol 42, No 4, p 254-258, October, 1981. 1 Fig, 2 Tab, 17 Ref.

Descriptors: *Urea, *Lakes, *Japan, Lake Yunoko, Nutrients, Seasonal variation, Natural waters, Nitrogen.

The seasonal trend of the distrib ution of urea, depth profiles and urea-N/total inorganic nitrogen (TIN) ratio were investigated in Lake Yunoko water samples. The importance of allochthonous urea as a source of urea in lake water was also investigated. Lake Yunoko is a moderately eutrophic, dimictic lake at altitude 1,478 meters in Tochigi Prefecture, Japan. The lake has a mean depth of 7.3 meters and the maximum depth of 12 meters. Surface area is 0.33 square kilometers. Except for temporary inflow of water from Konsei-zawa and Shirane-zawa after rain, the lake does not have any large inflowing streams. Allochthonous nutrients are supplied to the lake from the drainage of untreated sewage and hot-spring water from Yumoto Town. The water balance is mainly governed by inflow of groundwater from the lake bottom. Water samples were collected every 3 meters from surface to bottom at a central station. The annual minimum of the urea standing stock was 3.75 mg-at-N/sq m in November of 1971. The annual maximum was 61.0 mg-at-N/sq m under cover in March of 1972. Three out of six depth profiles of urea appeared to be nutrient types with depression of urea in the trophogenic layer, but increases in the tropholytic layer. In these cases, photosynthetic activities may regulate the urea depth profile. Urea appeared to be a major constituent of nitrogenous nutrients under ice-cover in March, but a minor component throughout the rest of the year. Allochthonous urea, which originated from wastewater treatment, seems to have been an important source of urea in water of Lake Yunoko. (Baker-FRC)
W83-00721

HIGH RESOLUTION VERTICAL PROFILES OF PH IN RECENT SEDIMENTS,
Case Western Reserve Univ., Cleveland, OH. Dept. of Geological Sciences.
J. B. Fisher, and G. Matisoff.
Hydrobiologia, Vol 79, No 3, p 277-284, 1981. 4 Fig, 2 Tab, 25 Ref.

Descriptors: *Hydrogen ion concentration, *Sedimentation, *Estuarine environment, *Natural waters, Chemical reactions, Estuaries, Long Island Sound, Lake Erie, Chesapeake Bay, Bays, Lakes, Vertical distribution.

A method is presented for examining surficial sediments on a millimeter scale. Profiles of pH were measured in cores from three widely differing environments and in laboratory microcosms. Cores were taken from Lake Erie, Stony Brook Harbor, and Whitehall Bay. The study demonstrated that pH profiles obtained using a microelectrode revealed the hydrogen ion to undergo chemical reactions on a scale far smaller than the classic 1 cm sampling interval. Pore water pH profiles were affected by bio-turbation. The presence of tubificids prevented profound alterations of pH in sediments treated with a layer of activated sewage sludge. In the absence of special precautions to avoid the loss of volatile gases, pH measurements of expressed pore water are woefully inaccurate. In all the sediments examined, a local pH minimum occurred immediately below the oxidized zone. In estuarine sediments, a second deeper pH minimum was noted. The technique presented is not limited to pH. Any chemical species that can be directly determined by electrodes may be studied this way. Microelectrode techniques could be useful in the study of chemical gradients around animal burrows and in time series studies of whole core diagenesis. (Baker-FRC)
W83-00729

SEABED DRIFTER MOVEMENT IN SAN DIEGO BAY AND ADJACENT WATERS,
Naval Oceans Systems Center, San Diego, CA.
For primary bibliographic entry see Field 2L.
W83-00738

AGRICULTURAL RUNOFF AS A NONPOINT EXTERNALITY: A THEORETICAL DEVELOPMENT,
Texas A and M Univ., College Station. Dept. of Agricultural Economics.
R. C. Griffin, and D. W. Bromley.
American Journal of Agricultural Economics, Vol 64, No 3, p 547-552, August, 1982. 1 Tab, 6 Ref.

Descriptors: *Nonpoint pollution sources, *Environmental policy, *Agricultural runoff, *Agricultural watersheds, *Economic aspects, Runoff, Public policy, Legal aspects, Water pollution control, Mathematical models, Environmental protection.

A theory dealing with agricultural runoff as a nonpoint externality was developed and explored. Nonpoint production functions can be relied upon to estimate the amount of pollution in the runoff of individual farms from their production activities. Economically efficient policies based on regulations and/or incentives can be designed based on the factors which actually determine pollution levels. Optimal parameters can be mathematically specified. A simple static model of the traditional point-source externality was used to evaluate four runoff policies. (Small-FRC)
W83-00747

SODIUM MOBILITY IN A MINI-CATCHMENT STUDIED WITH RADIOACTIVE TRACERS AND ARTIFICIAL PRECIPITATION,
Central Inst. for Industrial Research, Oslo (Norway).
N. Christophersen, H. M. Seip, C. Qvenild, and O. Tollan.
Nordic Hydrology, Vol 13, No 2, p 105-114, 1982. 3 Fig, 1 Tab, 23 Ref.

Descriptors: *Precipitation, *Acidic water, *Soil chemistry, Ion exchange, Salts, Chemical reactions, Sodium, Storgama, *Norway, Tracers, Artificial precipitation, Radioisotopes, Runoff, Acid rain, Acid streams.

The effect of sea salts on the acidity of runoff from an acidic catchment in Norway was investigated with Na24 and tritiated water as tracers. A natural 98 sq m mini-catchment was watered with artificial precipitation at an intensity of 5 mm per hour, 8 hours per day, 5 days per week for several weeks starting August 19, 1980. The tracers were administered on September 3. After 6 days an estimated 84% of the tritiated water and 45% of the Na24 were recovered in runoff. Na ions were fairly mobile but were delayed with respect to water movement. Some of the remaining Na24 ions remained in stagnant zones or took part in isotopic exchange, leaving less than half of the non-radioactive Na ions available for ion exchange with ions such as H+ in the soil. Mean monthly Na ions in precipitation falling on this section of Norway averaged 15 microequivalents per liter from 1977 to 1980. The < 10 microequivalents per liter Na available for ion exchange was of minor importance compared with the 50 microequivalents per liter of H+ in runoff. (Cassar-FRC)
W83-00753

RUNOFF CHEMISTRY AT A MINI-CATCHMENT WATERED WITH 'UNPOLLUTED PRECIPITATION,'
Central Inst. for Industrial Research, Oslo (Norway).
N. Christophersen, A. O. Stuanes, and R. F. Wright.
Nordic Hydrology, Vol 13, No 2, p 115-128, 1982. 5 Fig, 4 Tab, 15 Ref.

Descriptors: *Precipitation, *Acidic water, *Sulfates, *Soil chemistry, Chemical reactions, Storgama, *Norway, Artificial precipitation, Runoff, Acid rain, Acid streams.

An artificial precipitation, characteristic of preindustrial quality, was sprayed at the rate of 600 mm in 3.5 weeks on a 98 sq m mini-catchment in the Storgama area of Norway during August-September 1980. The applied precipitation contained 9 microequivalents per liter of H+ and 11 microequivalents per liter of sulfate compared with the 54 microequivalents per liter of H+ and 59 microequivalents per liter of sulfate in today's acidic precipitation. Within a week after the precipitation application began, H+ in runoff had declined to an average of 23 microequivalents per liter and sulfate to 30 microequivalents per liter. Al(3+) was also significantly reduced. Acidity was correlated to sulfate and organic ions but not to chloride. The amount of water-extractable sulfate in soil was equivalent to about half of the present yearly input. It is clear that a sudden 50% reduction in sulfate input considerably reduces runoff acidity. However, long-term effects of cleaner precipitation are difficult to predict because the extractable sulfur pool in the soil can be readily replenished from the other forms of sulfur, presently at 5-10 times the concentration of sulfate. Important factors governing the long-term changes in sulfate concentrations in soil and runoff are the biological and chemical processes involving sulfur transformations in the soil, oxygen supply, weather (dry warm weather favors sulfate formation in soil), and organic acids. (Cassar-FRC)
W83-00754

PATHWAY AND DISTRIBUTION OF TRACE ELEMENTS IN LAKE VANDA, ANTARCTICA,
Hokkaido Univ. (Japan). Graduate School of Fisheries.
N. Masuda, M. Nishimura, and T. Torii.
Nature (London), Vol 298, No 5870, p 154-156, July 8, 1982. 2 Fig, 1 Tab, 25 Ref.

Descriptors: *Chemical composition, *Lakes, Arctic zone, Polar regions, Arctic, Lake Vanda, *Antarctica, Trace elements, Heavy metals, Metals, Trace metals, Aluminum, Copper, Rubidium, Cesium, Nickel, Cobalt, Iron, Zinc, Path of pollutants.

Samples were taken in the austral summer season at 10 depths and in the inflow to Lake Vanda, situated in Wright Valley, Victoria Land, Antarctica. The inflow was from the Onyx River. The concentrations of 14 trace elements, including 7 elements not noted in prior studies, are reported. The concentrations were determined by instrumental neutron activation and atomic absorption methods. The elements included Sc, Cr, Co, Rb, Sb, Cs, Th, Al, Mn, Fe, Ni, Cu, Zn, and Sr. The bottom of the sampling site was 64.8 meters deep. The concentrations of Al, Fe, Ni, and Cu were determined by carbon furnace atomic absorption spectrometry after solvent extraction, and the other elements were determined by the instrumental neutron activation analysis. Every element except aluminum tended to increase with depth, and the profiles resemble those of chlorinity and temperature. The findings support the conclusion that the pathway of the trace elements observed was: tropospheric aerosol particles, precipitation, glacier, glacial melt water, Lake Vanda. Connate seawater introduced during the fjord age, seasalt particles, crustal weathering materials and grounded marine ice shelf could not have a major effect on the origin of trace elements in Lake Vanda. The layer below 45 meters deep was produced by a diffusion process of highly concentrated palaeolake water. The 60-64 meter depth was remarkably depleted in dissolved oxygen and contained hydrogen sulfide. The bottom layer was such that the chemical species in the layer should have a reduced form. (Baker-FRC)
W83-00756

ECOLOGY OF THE FOREST STREAM LANE BLOTO IN THE NIEPOLOMICE FOREST 1. CHEMISM OF WATER AND BOTTOM SEDIMENTS AND ITS CHANGES UNDER THE INFLUENCE OF INDUSTRIAL POLLUTION,

Jagiellonian Univ., Krakow (Poland). Inst. of Environmental Biology.
K. Jop.
Acta Hydrobiologica, Vol 23, No 2, p 107-123, 1982. 5 Fig, 5 Tab, 31 Ref.

Descriptors: *Heavy metals, *Bottom sediments, *Air pollution, Metals, Sediments, Lane Bloto, Krakow, *Poland, Niepolomice Forest, Fate of pollutants, Forest watersheds.

Water and bottom sediments for 5 stations and 4 tributaries of the stream Lane Bloto, Poland, were analyzed at monthly intervals during 1977-78. This forest stream receives dusts at the rate of 7 tons per sq km per month and gases from the Krakow industrial and powerplant complex. Concentrations of metals were: Cd, Pb, Ni, and Cu, 0-10 ppb in water and 0-20 ppm in sediments; Zn, 30-150 ppb in water and 30-200 ppm in sediments; and Fe. 250-950 ppb in water and 2200-2900 ppm in sediments. (Cassar-FRC)
W83-00763

A DEVICE TO MEASURE IN SITU LOTIC BENTHIC METABOLISM,
Calgary Univ. (Alberta). Dept. of Biology.
L. L. Osborne, and R. W. Davies.
Hydrobiologia, Vol 79, No 3, p 261-264, 1981. 2 Fig, 23 Ref.

Descriptors: *Benthos, *Metabolism, *Measuring instruments, Lotic environment, Running water, Bacteria, Oxidation, Microorganisms, Estimating, Primary productivity.

A method is described to measure in situ lotic benthic community metabolism partitioned into autotrophic, heterotrophic, bacterial and inorganic components of oxidation. The device has low construction and maintenance costs, is reliable, maintains a current within the chamber to prevent oxygen stratification and gives precise field estimates of benthic community metabolism in heterogenous substrates. The sampling unit consists of a transparent plexiglass cylinder, with an internal stirring mechanism connected to a base unit with a flanged head by two plexiglass rings separated by a cork gasket and secured with bolts and wingnuts. The base units are filled with natural substrate and buried in the substratum to the level of the plexiglass ring. Following a minimum 8 week colonization period the top chambers are filled with river water and attached to the buried base units. The changes in dissolved oxygen concentration within the chamber can be determined using either a dissolved oxygen, CO2, of pH probe inserted in place of a B-D vacutainer stopper or, by using the micro-Winkler technique. Using either technique with light and dark chambers primary production is estimated and with the incorporation of antibiotics and neutralized formalin the total community oxygen uptake can be partitioned into autotrophic, heterotrophic, bacterial, and chemical components. Verification of the technique is described. (Baker-FRC)
W83-00773

FORMATION OF FRESHWATER FE-MN COATINGS ON GRAVEL AND THE BEHAVIOR OF CO60, SR90, AND CS137 IN A SMALL WATERSHED,
Oak Ridge National Lab., TN. Environmental Sciences Div.
T. E. Cerling, and R. R. Turner.
Geochimica et Cosmochimica Acta, Vol 46, No 8, p 1333-1343, August, 1982. 13 Fig, 3 Tab, 26 Ref.

Descriptors: *Manganese oxides, *Iron oxides, *Radioisotopes, Fate of pollutants, Gravel, Cobalt radioisotopes, Strontium radioisotopes, Cesium radioisotopes, Streambeds, White Oak Creek, *Tennessee, Adsorption, Chemical precipitation.

Iron and manganese oxide coatings on gravel were studied in March-November 1979 in White Oak Creek watershed, Tennessee, impacted by a low-level radioactive waste burial site and several nuclear facilities. Fe-Mn-rich coatings formed on clean gravel and glass plates under oxidizing conditions and at dissolved Fe and Mn concentrations greater than 50 micrograms per liter. At lower Mn-Fe levels abrasion removed coatings in fast moving streams. Ratios of Mn and Fe were extremely variable and unrelated to the Mn:Fe ratios in the water. Annual accretion rates on glass plates at 2 locations were 1100-2100 micrograms per sq cm for Mn and 270-174 1750 micrograms per sq cm for Fe; on gravel, 320 micrograms per sq cm for both Mn and Fe. Mn coating material can dissolve and Fe oxides can precipitate under the following conditions: Eh, 100-300 mV; $<$ 1 mg per liter dissolved oxygen; and pH, 6.5-7.5. Radionuclides at levels below maximum permissible concentration levels were readily absorbed from waters by the Fe-Mn coatings. Co60, Sr90, and Cs137 behaved differently, according to the differences in their chemical natures. Contaminated gravel placed in clean waters lost Co60 by abrasion under oxidizing conditions and by dissolution under reducing conditions. Exchangeable Sr90 was completely gone after a month's exposure; nonexchangeable Sr90 was lost more slowly. Cs137 was totally retained for more than 8 months by the coated gravel. (Cassar-FRC)
W83-00788

CHANGES IN QUALITY OF FINNISH INLAND WATERS REVEALED BY GROUPING ANALYSIS,
National Board of Waters, Helsinki (Finland).
For primary bibliographic entry see Field 2H.
W83-00791

INTERACTIONS BETWEEN. SUSPENDED ORGANIC MATTER AND COPEPOD GRAZING IN THE PLUME OF THE HUDSON RIVER,
Medgar Evers Coll., Brooklyn.
For primary bibliographic entry see Field 2L.
W83-00793

THE SIGNIFICANCE OF NATURAL ENVIRONMENTAL FACTORS IN THE DISTRIBUTION OF COPPER IN POTABLE WATERS OF SRI-LANKA,
Peradeniya Univ., Sri lanka. Dept. of Geology.
C. B. Dissanayake, and U. G. M. Ariyaratne.
International Journal of Environmental Studies, Vol 15, No 2, p 133-143, 1980. 6 Fig, 16 Ref.

Descriptors: *Copper, *Fate of pollutants, *Wells, *Drinking water, *Geochemistry, Metals, Heavy metals, Water pollution sources, Soil water, Potable water, Geohydrology, Geography, Natural waters, Topography, Geology, Surveys, Climatology, *Sri Lanka.

As the second part of a program initiated by the Department of Geology of the University of Peradeniya, a survey was conducted to highlight the significance of natural environmental factors in relation to nutrition and health. The drinking water wells of the island of Sri Lanka could be divided into four main zones based on their copper (Cu) content. The distribution of Cu was found to be affected by geologic, topographic, climatic, pedologic, and structural factors. The geochemical status of an element in a particular area affects its changes for uptake in the food chain and in drinking water. An understanding of the factors influencing metal concentrations in natural waters and soil water may aid in the treatment of water for domestic and industrial use. (Geiger-FRC)
W83-00798

TITANIUM AND TUNGSTEN IN HIGHWAY RUNOFF AT PULLMAN, WASHINGTON,
Washington State Univ., Pullman. Dept. of Civil and Environmental Engineering.
D. R. Bourcier, E. Hindin, and J. C. Cook.
International Journal of Environmental Studies, Vol 15, No 2, p 145-149, 1980. 2 Fig, 2 Tab, 10 Ref.

Descriptors: *Fate of pollutants, *Tungsten, *Titanium, *Storm runoff, *Mathematical models, *Dusts, *Highways, Water pollution sources, Metals, Air pollution, Deposition, Storm drains, Urban runoff, Model studies, Roads, Pullman, *Washington.

The inputs of titanium (Ti) and tungsten (W) to a 2323 sq road surface area and their concentrations in road runoff were studied to formulate a model to predict metal loadings in road runoff. A viaduct at Pullman, Washington was chosen as a study site to exclude metal input from sources other than the road surface. Dustfall and precipitation were examined for Ti and W levels at the viaduct and at a control station. In the diluted precipitation sample digests which contained detection limits of 1.0 milligrams/liter for Ti and 15 milligrams/liter for W, neither metal was detected. W was not detected in dust samples, while average deposition rates for Ti were 43.6 milligrams/sq m/day at the viaduct site and 44.3 milligrams/sq m/day at the control station. The mean concentration of Ti in road runoff from 3 storm events was 12.7 milligrams/liter, while for W it varied from not detectable to 25 milligrams/liter. A mathematical model was developed which allowed prediction of metal loadings for a typical storm event utilizing total runoff volume data. (Geiger-FRC)
W83-00799

CHANGES IN THE ENVIRONMENTAL POLLUTION IN THE CALCUTTA-HOOGHLYSIDE INDUSTRIAL STRIP OF INDIA,
Kentucky Univ., Lexington. Dept. of Geography.
P. P. Karan.
International Journal of Environmental Studies, Vol 15, No 3, p 185-189, 1980. 3 Tab, 11 Ref.

Descriptors: *Wastewater pollution, *Industrial wastes, *Surveys, Water pollution sources, Calcutta, *India, Hooghly River, Air pollution, Attitudes, Wastewater disposal, Waste disposal, Pulp and paper industry, Urban areas, Water supply, Public opinion.

Residents of the Calcutta-Hooghlyside industrial belt in India showed increasing awareness of water and air pollution in their community. This was determined by results of two surveys conducted in 1974 and 1978. During each survey the same questions were asked of a representative group of 240 persons. There was a positive correlation between the frequency at which persons perceived air and water pollution in their communities and the actual level of pollution. All interviewees accurately identified the areas with the most serious pollution. Respondents cited the major sources of pollution characteristic of their locality (vehicle exhaust and garbage in central Calcutta and jute and paper mill effluents in industrial areas). Few persons mentioned monetary damages from pollution. Although nearly 90% of the interviewees cited a need for improved water supplies, only a few associated polluted drinking water with disease. Of persons living in the most polluted areas 54% in 1974 and 65% in 1978 were pessimistic about government enforcement of pollution control regulations. Water pollution in this region is widespread. Sources of pollution to the Hooghly River and other water bodies are raw sewage, dead bodies, bathing and dishwashing in ponds, and untreated industrial wastes, mainly from pulp and paper mills, jute mills, and tanneries. Only 46% of the region is sewered. (Cassar-FRC)
W83-00801

TRACE METAL CONTENT IN THE LALBAG POND OF BARODA CITY NEAR THE HIGHWAY,
Baroda Univ. (India). Dept. of Pharmacy.
Y. K. Agrawal, K. P. S. Raj, and S. S. Merh.
International Journal of Environmental Studies, Vol 15, No 1, p 57-58, 1980. 2 Tab, 9 Ref.

Descriptors: *Water analysis, *Lead, *Cadmium, Pollutant identification, Water pollution sources, Heavy metals, Metals, Ponds, Highways, Baroda City, *India, Water quality, Lalbag Pond.

Water at six sites in Lalbag Pond, near the major highway of Baroda City, India, contained 5-18 mg per liter Pb and 0.07-0.10 mg per liter Cd. These levels were up to 360 times the permissible level of 0.05 mg per liter for Pb. Levels of Cd were 7-10 times higher than the maximum allowable 0.01 mg per liter Cd. The source of these metals was believed to be highway vehicle exhaust. Levels of 13

other metals were also determined. In addition, the BOD concentration of 9 mg per liter and COD concentrations of 11-14 mg per liter exceeded the limits of 6 and 10 mg per liter, respectively. This water is used by cattle and humans and as a source of fish for food. (Cassar-FRC)
W83-00803

AQUATIC DISTRIBUTION AND HETEROTROPHIC DEGRADATION OF POLYCYCLIC AROMATIC HYDROCARBONS (PAH) IN THE TAMAR ESTUARY,
Plymouth Polytechnic (England). Dept. of Environmental Sciences.
J. W. Readman, R. F. C. Mantoura, M. M. Rhead, and L. Brown.
Estuarine, Coastal and Shelf Science, Vol 14, No 4, p 369-389, April, 1982. 10 Fig, 2 Tab, 49 Ref.

Descriptors: *Hydrocarbons, *Estuaries, *Chemical analysis, *Sediments, *England, Water columns, Distribution, Estuarine environment, Tamar Estuary.

The distribution of selected PAH in the water and sediments of the Tamar Estuary and microbial degradation of selected PAH in the water column were investigated. The findings were compared with variations in salinity, pH, temperature, dissolved oxygen, ammonia and suspended solids. Concentrations of individual PAH typically molecular weight PAH including naphthalene, phenanthrene and anthracene, and the higher molecular weight homologues. Group 1 showed a complex distribution throughout the estuary with no significant correlations with either salinity or suspended particulates. Volatilization was proposed as an important process in determining their fate. In contrast the heavier PAH compounds highly significant correlations with suspended particulates. Highest concentrations occurred at the turbidity mixmum, with a secondary concentration maximum localized to the industrialized portion of the estuary and associated with anthropogenic inputs. Degradation rates correlated positively with suspended solids. The high particulate affinity and microbial refractivity of these group 2 PAH indicate sediment burial as the principal fate of these PAH in the estuary. Estuarine sediments contained typically 50-1500 ng/g dry weight of individual PAH which were comparable to the levels of group 2 PAH associated with the suspended particulates. Highest concentrations occurred at the riverine end resulting from unresolved inputs in the catchment. Subsequent dilution by less polluted marine sediments along with slow degradation resulted in a seaward trend of decreasing concentrations. A secondary maximum of PAH was superimposed on this trend and was associated with the urban area of Plymouth. (Baker-FRC)
W83-00808

LOCAL VARIABILITY IN THE DISTRIBUTION OF WINDSCALE FISSION PRODUCTS IN ESTUARINE SEDIMENTS,
International Lab. of Marine Radioactivity, Monte Carlo (Monaco). Oceanographic Museum.
S. R. Aston, and D. A. Stanners.
Estuarine, Coastal and Shelf Science, Vol 14, No 2, p 167-174, February, 1982. 3 Fig, 5 Tab, 9 Ref.

Descriptors: *Radionuclides, *Estuaries, *Sediments, Fission products, *Radioactive wastes, Windscale, Irish Sea, Intertidal areas, Ravenglass estuary.

The local variability of Ce-144, Ru-106, Cs-137, and Cs-134 activities was determined at a site in the Ravenglass estuary. Significant variations were found in the local distribution of fission products in surface sediment samples. The estuary is contaminated by Windscale radioactive effluents. The variations in fission product activities are small in the surface sediments from an intertidal bank, but considerable variations are found for sediments taken from a transect through tidal channel, intertidal bank and salt marsh areas. The grain-size distributions within local areas of sediment seem to control fission product activities, but do not exert differential controls on individual readionuclides. Salt marsh areas appear to be accumulating sediments at slower rates than the adjacent intertidal areas, and this produces a decay controlled influence on the shorter-lived fission products. The results indicate that care must be taken in the use of estuarine sediment sampling to evaluate the external gamma dose to the public frequenting such locations, as small-scale areal variations in radionuclide activities for surface sediments are significant. (Baker-FRC)
W83-00810

EXCHANGE OF NITRATE, AND THE PRODUCTS OF BACTERIAL NITRATE REDUCTION, BETWEEN SEAWATER AND SEDIMENTS FROM A U.K. SALTMARSH,
Essex Univ., Colchester (England). Dept. of Biology.
For primary bibliographic entry see Field 2L.
W83-00812

TRACE METAL PARTITIONING IN THE AQUEOUS SURFACE MICROLAYER OF A SALT MARSH,
Naval Research Laboratory, Washington, DC.
R. Pellenbarg.
Estuarine, Coastal and Shelf Science, Vol 13, No 1, p 113-117, July, 1981. 1 Fig, 2 Tab, 20 Ref.

Descriptors: *Salt marshes, *Trace metals, *Organic solvents, Canary Creek Marsh, *Delaware, Acetone, Path of pollutants, Tidal marshes, Marshes, Estuarine environment, Estuaries, Cadmium.

The partitioning of trace metals, particularly in the organic solvent extractable fraction of a salt marsh surface microlayer, was investigated. Knowledge of this partitioning will assist in understanding the fate and influence of the surface microlayer as it is sorbed onto estuarine materials or assimilated by the estuarine biosphere. Gram sized samples of microlayer material were collected under low current conditions about 1 hr after start of ebb tide in Canary Creek Marsh, a salt marsh near Lewes, Delaware, in July of 1979. The largest proportion of trace metals in the whole microlayer sample was associated with materials not extracted by the various organic solvents used. Acetone was the organic solvent which extracted the largest proportion of metal bearing organic materials from the whole microlayer sample, except that acetone extracted only a minor portion of the total cadmium present. These organic materials have humic and fulvic acid characteristics in their infrared spectra. These organically associated metals could presumably be more readily available to marsh and estuarine biota than metals retained in inorganic phase. However, 12% of the total cadmium in the surface microlayer was organic-soluble, and cadmium could represent one metal easily converted from inorganic atmospheric precipitation to a bioactive organic form. (Baker-FRC)
W83-00814

THE APPLICATION OF RADIOISOTOPES IN THE STUDY OF ESTUARINE SEDIMENTARY PROCESSES,
Institute for Marine Environmental Research, Plymouth (England).
R. J. Clifton, and E. I. Hamilton.
Estuarine, Coastal and Shelf Science, Vol 14, No 4, p 433-446, April, 1982. 3 Fig, 3 Tab, 26 Ref.

Descriptors: *Radionuclides, *Estuaries, *Sedimentation, Sedimentation rates, Sediment transport, Ruthenium, Cesium, Polonium, Americium, Mixing, Spatial distribution, Distribution, Irish Sea, Salt marshes, Esk Estuary, *England.

The use of radionuclide distributions and ratios as indicators of sedimentation and remixing processes within the Newbiggin area of the Esk estuary was investigated. It was demonstrated how, in conjunction with other physical and chemical characteristics of the sediments, these radionuclides may influence the ultimate fate of the non-conservative radioisotopes present in the region. The estuary is flanked by an emerging salt marsh and is a region exposed to a variety of radionuclides resulting from the activities of the British Nuclear Fuels Ltd. The dominant sediment of the area is a coarse grained sand resting on beds of indurated shingle. In the estuary, tidal movement of sediment results in the deposition of local areas of fine grained arenaceous silt on sands. The concentration of non-conservative radionuclides in surface sediments of the area cannot be described by a single parameter, but there is a high correlation of organic C, Cu, Al and the Si:Al ratio with particle size. The preservation of the historical record of the BNFL effluents in the Esk sediment is dependent on the hydrology of the area, which affects accretion, erosion, and remixing. Sedimentation rates at sites of accretion vary between 0.5 and 3 cm/year. However, at some sites they are much higher, about 6 cm/yr in the top 10 cm, but they are not consistent throughout the depth profiles. Some cores show evidence of continous accretion, but no significant radioactivity was detected at depths below 35-40 cm, indicating an overall sedimentation rate of about 1.5 cm/yr for the 25-30 yr period since BNFL effluents first entered the Irish Sea. (Baker-FRC)
W83-00818

ECOLOGICAL EFFECTS OF MINE EFFLUENTS ON THE SOUTH ESK RIVER, NORTH-EASTERN TASMANIA, II. TRACE METALS,
Canberra College of Advanced Education (Australia).
R. H. Norris, R. Swain, and P. S. Lake.
Australian Journal of Marine and Freshwater Research, Vol 32, No 2, p 165-173, 1981. 4 Tab, 13 Ref.

Descriptors: *Mine drainage, Rivers, *Water pollution sources, *Metals, Copper, Lead, Zinc, Manganese, Sediments, South Esk River, Tasmania, Iron, Mine wastes, Industrial wastes, *Australia.

The concentrations of trace metals in the sediments associated with suspended solids and dissolved in the water of the South Esk River in Tasmania were examined as part of a study on the ecological effects of mine effluents. Concentrations of Mn, Fe, Cd, Zn, Cu, and Pb in sediments and in the water column of the River were measured. Mn and Fe concentrations were independent of the mine effluents. The natural background levels of Cd, Zn, Cu, and Pb were very low or below detection limits. In the stretch of river up to 130 km below a source of contamination, the concentrations of these four metals in the sediments, associated with the non-filterable residue, and in solution were all above the natural background levels. The factors controlling the concentrations of Cd, Zn, Cu, and Pb in the sediments were not clear. However, sediment type appeared to be important. The concentrations of Cd and Zn in solution were inversely related to the distance from the source of contamination, whereas the concentrations of Cu and Pb in solution amd of all four metals associated with the non-filterble residue did not vary significantly. Most of the metal load carried to the South Esk River by Storys Creek is probably in solution rather than in other fractions. (Baker-FRC)
W83-00832

COPPER, ZINC, AND CADMIUM CONCENTRATIONS OF RESIDENT TROUT RELATED TO ACID-MINE WASTES,
California Dept. of Fish and Game, Redding.
D. Wilson, B. Finlayson, and N. Morgan.
California Fish and Game, Vol 67, No 3, p 176-186, July, 1981. 1 Fig, 3 Tab, 28 Ref.

Descriptors: *Acid mine drainage, *Fish, *Bioaccumulation, *Heavy metals, *Copper, *Zinc, *Cadmium, Trout, Mine drainage, Acid streams, Water pollution effects, Path of pollutants.

To determine the influences of acid mine wastes from Little Squaw, Little Backbone, and Spring Creeks discharges on copper, zinc, and cadmium concentrations in fish muscle and liver tissues, 38 fish from four locations in the upper Sacramento River basin were captured and analyzed. Three of the locations receive documented inputs of acid mine wastes, while the fourth location does not. Fish from this latter location served as a study control. If metal concentrations in fish taken from

the acid mine waste-influenced locations were above the background level, a reevaluation of the water quality management programs associated with the mine discharges would be indicated. Flesh concentrations of copper, zinc, and cadmium in resident trout from the upper Sacramento River basin were similar to background concentrations in fish from the continental United States. Metal concentrations in water and trout liver did, however, progressively increase downstream from the locations of lowest water metal concentrations as influences from the acid mine wastes increased. There is good evidence that the trout populations of both Shasta Lake and the Sacramento River below Shasta Dam are receiving detrimental exposures to copper and cadmium, and new programs for controlling the discharges of the aicd mine wastes influencing these areas may be needed. (Baker-FRC)
W83-00862

RUNOFF WATER QUALITY FROM DAIRY PASTURES IN THE PIEDMONT REGION,
Clemson Univ., SC. Dept. of Agricultural Engineering.
L. E. Reese, R. O. Hegg, and R. E. Gantt.
Transactions of the ASAE, Vol 25, No 3, p 697-701, May/June, 1982. 8 Fig, 6 Tab, 10 Ref.

Descriptors: *Water quality, Rainfall-runoff relationships, Rainfall, *Runoff, *Water pollution sources, Manure, Fertilizers, Bacteria, Fecal coliform, Coliforms, Slope, Vegetation, *South Carolina, *Piedmont Region.

Background levels on the quantity and quality of surface runoff from pasture lands of the Piedomont Region were determined. Runoff water quality after surface application of dairy wastes to pasturelands was determined based on recommended nitrogen application rates. Eight 0.012 ha boardered pasture plots at Clemson dairy farm were used to collect, measure and sample natural and simulated surface runoff events. The vegetative cover was primarily tall Kenturcky 31 fescue and some ladino clover. The plot was of Cecil clay soil type with a 3-5% slope. The background rainfall events which produced runoff indicated a mean runoff producing rainfall of 3.81 cm, a mean runoff of 0.69 cm, and a mean percent runoff of 22.2%. All background concentrations are rather low as expected from an unfertilized pasture and would offer little pollution potential with the exception of coliform levels. Total coliform and fecal coliform bacteria levels on the unfertilized pasture were higher than allowed for public water supply standards. Nitrate-nitrogen levels were all well below permissible standards of 10 mg/liter. Surface application of dairy manure slurry produced higher initial runoff concentrations of total kjeldahl nitrogen (TKN), phosphate-phosphorus, chemical oxygen demand, and total solids compared to counterpart dry manure applications. After initial runoff periods, surface applications of dry dairy waste produced slightly higher runoff concentrations of TKN, phoshate-phosphorus, COD and total solids compared to counterpart slurry applications. Following four runoff events, TKN, COD, and TS runoff was at a low stable concentration. Seven runoff events lowered phosphate phosphorus to stable concentrations. (Baker-FRC)
W83-00870

THE UPTAKE OF PHOSPHATE BY CAREX SPECIES FOR OLIGOTROPHIC TO EUTROPHIC SWAMP HABITATS,
Western Australia Univ., Nedlands. Dept. of Agronomy.
B. J. Atwell, M. T. Veerkamp, B. Stuiver, and P. J. C. Kuiper.
Physiologia Planatarium, Vol 49, No 4, p 487-494, August, 1980. 1 Fig, 9 Tab, 34 Ref.

Descriptors: *Phosphates, *Kinetics, *Trophic level, *Nutrient requirements, *Swamps, *Rooted aquatic plants, *Adsorption, Phosphorus, Eutrophication, Nutrients, Marshes, Plant growth, Marsh plants, Roots, Path of pollutants.

The uptake of phosphate by excised roots of six species of swamp sedges (Carex) taken from a wide range of ologotrophic to eutrophic swamps was studied under controlled laboratory conditions. All species showed two phases for inorganic phosphate uptake in the concentration range of 0.01-50 micromoles of incorganic phosphate. In phase 1, C. rostrata and C. lasicocarpa had relatively high kinetic constants, whereas species from more eutrophic areas had intermediate values. The lowest kinetic constant values were observed in C. limosa and C. hudsonii. In phase 2, the kinetic cosntants showed little variation except for higher values for C. lasicocarpa, suggesting a similar carrier mechanism for inorganic phosphate in all species. Results for phosphate uptake and leakage are examined in relation to species habitat and in relation to data on agricultural crops which exhibit a lower affinity for phosphate uptake. (Geiger-FRC)
W83-00874

ESTUARINE METAL MONITORING IN SOUTHERN BRAZIL,
Rio Grande Univ. (Brazil). Lab. de Botanica Marinha.
U. Seeliger, and R. Braga Knak.
Marine Pollution Bulletin, Vol 13, No 7, p 253-254, July, 1982. 1 Tab, 5 Ref.

Descriptors: *Estuaries, *Heavy metals, *Water pollution sources, Fate of pollutants, Sediments, Copper, Mercury, Algae, *Brazil, Patos Lagoon, Industrial wastes.

A baseline study was made to assess dissolved and particulate copper and total mercury concentrations at the mouth of the Patos Lagoon estuary in southern Brazil and in the algal genus Enteromorpha in order to ascertain the impact of a large industrial district and rapid expansion of a superport in the area. Samples were collected monthly for a period of a year. The highest average total Hg concentrations of 0.164 micrograms/liter in sediment and organic-rich low salinity waters at the control station correspond to the natural background levels reported for estuarine and freshwater systems, although average particulate and dissolved Cu concentrations were slightly above natural levels. Tissue concentrations of Hg and Cu in Enteromorpha sp indicated either elevated background levels or low pollution levels, with notable addition of both metals at the sampling site nearest the industrial and port activities. (Baker-FRC)
W83-00880

A FIELD STUDY OF ESTUARINE POLLUTION IN MADRAS, INDIA,
Ibadan Univ. (Nigeria). Dept. of Preventive and Social Medicine.
M. K. C. Sridhar.
Marine Pollution Bulletin, Vol 13, No 7, p 233-236, July, 1982. 1 Fig, 6 Tab, 5 Ref.

Descriptors: *Water pollution effects, *Water pollution sources, *Estuaries, *Fish populations, *India, Madras, Wastewater, Ennore estuary, Buckingham canal, Cooum estuary.

Water quality was studied in three estuaries in Madras, South India: Cooum estuary, Buckingham canal and Ennore estuary. These three carry untreated or partly treated wastes from Madras city, including both domestic sewage and industrial wastes. The Buckingham canal is grossly polluted, with no surface flow. The Cooum estuary, though grossly polluted, because of the flow and flushing into the sea may be restored if precautions are taken. The Ennore estuary, with a large volume of water flowing, has a peculiar problem at the mouth due to continuous formation of a sand bar due to long-shore currents. This sand bar prevents the flushing of the estuarine water. As a result the pollutants discharged either in the estuary or in the sea accumulate at the mouth. This pollution, with impaired self-purification of the estuary, resulted in a decrease in fish production. (Baker-FRC)
W83-00881

A MONITORING/MODELING STRATEGY FOR 208 IMPLEMENTATION,
Purdue Univ., Lafayette, IN. Dept. of Agricultural Engineering.
D. B. Beasley, L. F. Huggins, and E. J. Monke.
Tranactions of the ASAE, Vol 25, No 3, p 654-660, 665, May/June, 1982. 3 Fig, 1 Tab, 4 Ref.

Descriptors: *Nonpoint pollution sources, *Model studies, Simulation, Pollution load, Water quality, Water management, Monitoring, ANSWERS, Watersheds, Sediment yield, Sediment transport, Water resources development.

The manner in which a well-adapted simulation model can be used as both a planning and evaluation tool for agricultural nonpoint source pollution has been demonstrated with two case studies. Such results are a direct consequence of using a model which is constructed from established cause-effect relationships between governing processes and is designed to analyze impacts of the type of control measures selected. A simulation model that analyzes cause-effect relationships in a site specific manner is the only methodology currently available for rational planning or evaluation off storm induced nonpoint source pollution control. The Finely Creek case study demonstrated how ANSWERS (Areal Nonpoint Source Watershed Environmental Response) simulations could be used in a planning role to quantify Best Management Practices (BMP) impacts and rank site specific BMPs. Maximum benefits from simulation accrue when it is applied at the earliest project planning stages. This example also illustrates how a ranking of alternative control strategies depends on the user in the selection of a baseline condition. The Black Creek Study demonstrated that it is impossible to quantify benefits from individual BMPs by monitoring the outlet of a natural, diverse watershed. The annual reduction in sediment yield from only 10% from the eastern third of the watershed to 30% from the western, most densely treated, third. Further, simulation studies indicated that a reduction of 50% was feasible if the installed structural BMPs had been augmented with chisel plowing in selected critical areas. (Baker-FRC)
W83-00890

DISPERSIVE TRANSFER AND PESTICIDE PROPAGATION IN A SUBMERGED RICE-FIELD (TRANSFERTS DISPERSIFS ET PROPAGATION DE PESTICIDES DANS UN SOL DE RIZIERE INONDEE),
Montpellier-2 Univ. (France). Lab. d'Hydrologie Mathematique.
F. Brissaud, P. Heurteaux, J. Podlejski, and P. Moutonnet.
Journal of Hydrology, Vol 57, No 3/4, p 233-245, June, 1982. 3 Fig, 1 Tab, 8 Ref. English summary.

Descriptors: *Infiltration, *Pesticides, Fate of pollutants, Insecticides, Tracers, Groundwater pollution, Degradation, Aquifers, Submerged beds, Rice, *France.

Infiltration of deuterated water in an experimental rice field in southern France showed uneven penetration of the soil. This may explain the transport toward the deep aquifer of small quantities of pesticides (gamma HCH and parathion) in spite of their rapid degradation in water and adsorption onto solids. The variability of the flow paths made it impossible to compare the two methods for measuring infiltration: a gamma neutron probe for deuterated water concentrations in the field and porous cup samples of soil solutions analyzed in the laboratory. (Cassar-FRC)
W83-00907

AN APPROACH TO THE STUDY OF TRANSVERSE MIXING IN STREAMS,
Research Inst. for Water Resources Development, Budapest (Hungary).
For primary bibliographic entry see Field 2E.
W83-00909

HEAVY METALS POLLUTION OF THE UPPER ARKANSAS RIVER, COLORADO, AND ITS EFFECTS ON THE DISTRIBUTION OF THE AQUATIC MACROFAUNA,
Bureau of Reclamation, Denver, CO. Engineering and Research Center.
For primary bibliographic entry see Field 5C.
W83-00921

THE USE OF CALIBRATED LAKES AND WATERSHEDS FOR ESTIMATING ATMOSPHERIC DEPOSITION NEAR A LARGE POINT SOURCE,
Ontario Ministry of the Environment, Rexdale.
P. J. Dillon, D. S. Jeffries, and W. A. Scheeider.
Water, Air, and Soil Pollution, Vol 18, No 1-3, p 241-258, 1982. 1 Fig, 14 Tab, 31 Ref.

Descriptors: *Air pollution, *Water pollution sources, *Chemical analysis, Sulfates, Nitrates, Hydrogen ion concentration, Calcium, Magnesium, Sodium, Potassium, Ions, Cations, Anions, Carbonates, Watersheds, *Ontario, Lakes.

The input and output rates of substances to and from both lakes and watersheds in the Sudbury and Muskoka-Haliburton areas of Ontario were measured. Mass balance studies were conducted in Sudbury on 5 lakes and their watersheds for 2.5 years. At Muskoka-Haliburton mass balances were measured for 6 lakes and 30 watersheds for 5 years. The findings suggest that the output of sulfate from the calibrated watersheds was substantially greater than the input measured as bulk deposition. The sulfate concentrations of the lakes could not be explained on the basis of the measured inputs. An additional input directly to the lake surface was needed to obtain a mass balance. The net input of acids measured as bulk deposition to the watersheds was much less than the acid consumed, which was estimated by the net output of Ca(++), Mg(++), Na(+), K(+), Al(3+) and the net reduction of N03(-). The major cation content of the study lakes could be explained on the basis of weathering reactions in the lakes' watersheds only if the input of strong acid has been underestimated. When the observation were quantified, they indicated that a major portion of the total input of S04(2-) precursors and of strong acid was not included in the bulk deposition measurements. Deposition of sulfate is the most likely explanation for these observations. (Baker-FRC)
W83-00953

LAKE ONTARIO ATMOSPHERIC DEPOSITION, 1969-1978,
Department of the Environment, Burlington (Ontario).
C. H. Chan, and K. W. Kuntz.
Water, Air and Soil Pollution, Vol 18, No 1-3, p 83-99, 1982. 18 Fig, 2 Tab, 22 Ref.

Descriptors: *Lakes, *Air pollution, *Chemical analysis, Sulfates, *Lake Ontario, Great Lakes, Nitrogen, Hydrogen ion conductivity, Specific conductivity, Ions, Anions, Cations, Silicates, Phosphorus.

Ten years of chemical data are summarized and discussed as they relate to temporal and spatial variation in the composition of atmospheric depostion in the Lake Ontario Basin. Six sampling sites include two locations, Burlington and Toronto Island in large urban centers and four located on the outskirts of small urban centers. Stations located near urban centers usually had higher specific conductance readings and displayed a prominent seasonal variation pattern. Time plots of pH data indicated decreases in readings during 1973 and 1975 at all stations. The biggest change occurred around 1974. Essentially the same time trend was characterized by all the cations studied at all locations, with sharp decreases occurring in the annual average concentrations between 1972 and 1973. Sources of major ions in the atmosphere include windblown dust, sea spray, volcanic eruption, and emission from industrial activities, with the last cause being the most probable in this area. Annual average sulfate concentration varied between 5.0 and 8.0 mg/liter over most of the study period, with slightly higher levels occurring in 1970 and 1971. Sulfate in the atmosphere was largely the result of the burning of fossil fuels and accounts for the higher occurrence of the anion near Burlington and Toronto. Average silicate concentrations showed the greatest decline during the study, dropping from an average of more than 3.0 mg/l before 1974 to less than 0.2 mg/liter after 1975. Higher concentrations of nitrogen were noted at Toronto and Burlington. Two features emerge from the study. First, at all six locations there were similar variations over the study period. Second, an abrupt change took place in the composition of atmospheric deposition in the early seventies. (Baker-FRC)
W83-00954

MODERN AND PALEOLIMNOLOGICAL EVIDENCE FOR ACCELERATED LEACHING AND METAL ACCUMULATION IN SOILS IN NEW ENGLAND, CAUSED BY ATMOSPHERIC DEPOSITION,
Maine Univ. at Orono. Dept. of Geological Sciences.
D. W. Hanson, S. A. Norton, and J. S. Williams.
Water, Air, and Soil Pollution, Vol 18, No 1-3, p 227-230, 1982. 7 Fig, 1 Tab, 42 Ref.

Descriptors: *Leaching, *Soil properties, *Metals, Accumulation, Lead, Zinc, Manganese, Magnesium, Cadmium, Calcium, Aluminum, *New England, Air pollution, Fallout, Atmosphere, *Acid rain.

In the absence of historic data about the chemistry of soils it is possible to evaluate the long term effects of acidic precipitation by examining comparable organic soil litter along a pH gradient or by examining the chemistry of lake sediments deposited over a long period of time. Such examinations include long term water quality data such as total dissolved solids, concentrations of specific metals and changes in conductivity; cation exchange capacity and base saturation values for soils located on precipitation pH gradients; lysimeter studies; and chemical analysis of organic soils on precipitation pH and metal gradients. Such evidence indicates that lead has been accumulating at an accelerating rate in New England soils, and therefore in lake sediments, for at least 100 years; and that zinc has been accumulating at an accelerating rate in New England soils which are circumneutral. In acidic or acidified soils, there is a net loss of zinc due to solution by acidic precipitation. The zinc concentration in lake sediments in acidifying drainage basins decreases at the ambient pH decreases. Accelerated leaching of potassium, calcium, magnesium, and manganese has occurred over the last 100 years, at least in areas with originally acidic soils, and more recently in areas where soils have become acidified or are circumneutral. (Baker-FRC)
W83-00956

TRANSFORMATION OF BENZO(A)PYRENE IN A MIXTURE WITH PHENOLS UNDER THE EFFECT OF ALGAE AND THEIR ENZYME PREPARATIONS,
Irkutskii Gosudarstvennyi Univ. (USSR). Scientific Research Inst. of Biology.
L. I. Belykh, D. I. Stom, and U. E. Kirso.
Water Resources, Vol 8, No 4, p 461-464, July/August, 1981. 4 Fig, 17 Ref. Translated from Vodnye Resursy, No 4, p 185-188, July/August, 1981.

Descriptors: *Aquatic plants, *Benzopyrene, *Phenol, *Degradation, Wastewater treatment, Algae, Carcinogens, Industrial wastewater, Pulp wastes, Enzymes, Oxidation, Kinetics, Nitella sp., Elodea canadensis, Hydrocarbons, Aromatic compounds, Organic compounds.

The effects of phenol, Nitella algae, or polyphenol oxidase preparations on the transformation of benzo(a)pyrene (BAP), a typical polyaromatic hydrocarbon carcinogen, was studied in water. The concentration of BAP was 1 times 10 to the minus 10th power M; concentrations of phenol were 5 times 10 to the minus 4th power M or 1 times 10 to the minus 6th power M. In the presence of Nitella, BAP concentrations decreased linearly with time over the 80 hour test period, faster with a higher concentration of organisms. Adding phenol to the solution increased the transformation rate of BAP with and without the presence of algae. However, the presence of BAP inhibited the oxidation of phenol with and without algae added. Polyphenol oxidase prepared from Nitella strongly increased the BAP transformation rates, which increased with increases in the concentration of enzyme from 0.6 to 2.5 mg per liter. Results showed that the transformation of BAP was largely caused by enzymatic oxidation in the presence of algae. Experiments with pulp and paper effluents reduced BAP concentrations of 5.7 times 10 to the minus 11th power M to 3.6 times 10 to the minus 11th power M in 7 days. Exposing pulp and paper mill wastewater to aquatic plants for 7 days reduced original BAP concentration of 5.7 times 10 to the minus 11th power M to 3.6 times 10 to the minus 11th power M with water thyme (Elodea canadensis) and from 6.7 times 10 to the minus 11th power to 4.8 times 10 to the minus 11th power M with Nitella. (Cassar-FRC)
W83-00961

MEASUREMENT OF TIME OF TRAVEL AND DISPERSION IN STREAMS BY DYE TRACING,
Geological Survey, Reston, VA. Water Resources Div.
E. F. Hubbard, F. A. Kilpatrick, L. A. Martens, and J. F. Wilson, Jr.
Available from Branch of Distr., USGS, 1200 S. Eads St., Arlington, VA 22202 $5.00. Geological Survey Techniques of Water-Resources Investigations Book 3, Chapter A9, 1982. 44 p, 29 Fig, 1 Tab, 38 Ref.

Descriptors: *Dye releases, *Tracers, *Dye dispersion, *Path of pollutants, Streams, Tracking techniques, Contaminants, Waste assimilative capacity, Concentration time, Data collections, Sampling, Discharge measurement, Fluorometry, *Time-of-travel studies.

The use of fluorescent dyes and tracing techniques provides a means for measuring of time-of-travel and dispersion characteristics of steady and gradually varied flow in streams. Measurements of the dispersion and concentration of tracers give insight into the behavior of soluble contaminants that may be introduced to a stream. This manual briefly discusses dispersion as it takes place in a stream, the importance of allowing for an initial mixing period, and how to accomplish this in field tests. The various dye tracers are considered with rhodamine WT being recommended. Dosage equations and curves are provided to permit selecting dye amounts to match stream discharges, velocities, and test lengths such that excessive concentrations are not produced. (USGS)
W83-00985

SULFUR ISOTOPIC COMPOSITION AND WATER CHEMISTRY IN WATER FROM THE HIGH PLAINS AQUIFER, OKLAHOMA PANHANDLE AND SOUTHWESTERN KANSAS,
Geological Survey, Denver, CO. Water Resources Div.
For primary bibliographic entry see Field 2F.
W83-00987

HYDROLOGIC EFFECTS OF HIGHWAY-DEICING CHEMICALS IN MASSACHUSETTS--EXECUTIVE SUMMARY,
Geological Survey, Boston, MA. Water Resources Div.
For primary bibliographic entry see Field 4C.
W83-01008

LAPLACE TRANSFORM SOLUTIONS FOR SOLUTE TRANSPORT IN FISSURED AQUIFERS,
Institute of Geological Sciences, Oxfordshire (England).
For primary bibliographic entry see Field 2F.
W83-01027

METAL SULFIDES IN ESTUARINE SEDIMENTS,
Kean Coll. of New Jersey, Union. Dept. of Chemistry/Physics.
G. W. Luther, A. L. Meyerson, J. J. Krajewski, and R. Hires.
Journal of Sedimentary Petrology, Vol 50, No 4, p 1117-1120, December, 1980. 4 Fig, 16 Ref.

Descriptors: *Estuaries, *Sulfides, *Sediments, Sedimentation, Estuarine environment, Metal com-

plexes, Iron, Iron sulfides, Pyrite, Crystals, Framboids, Newark Bay, Nickel, Manganese, *New Jersey.

The formation of iron sulfides in marine sediments has been a subject of intensive investigation. Preliminary X-ray diffraction analyses on bulk sediment samples from Newark Bay showed weak to medium intensity peaks which could be assigned to various sulfide minerals. Analysis by scanning electron microscopy (SEM) with semi-quantitative energy dispersive X-ray spectrometer (EDS) shows that these sediments contain both pyrite and metastable iron monosulfide minerals. The pyrite particles are usually found as framboids. All crystals, whether separate or in aggregates, fall in a size range of 0.5 to 7.0 microns. The crystals have been found throughout the upper 30 cm of the sediments studied to date and at various locations throughout Newark Bay. This is the first report of framboidal sulfide minerals which contain a cation other than iron as the major constituent in recent estuarine sediments. Nickel and manganese are incorporated into the structure of pyrite and iron monosulfide crystals, respectively. These crystals are formed during sulfate reduction to sulfides in the estuarine system. (Baker-FRC)
W83-01044

5C. Effects Of Pollution

THE TROPHIC RESPONSE OF CILIATED PROTOZOANS IN FRESHWATER LAKES,
Florida Univ., Gainesville. Dept. of Environmental Engineering Science.
J. R. Beaver, and T. L. Crisman.
Limnology and Oceanography, Vol 27, No 2, p 246-253, 1982. 5 Fig, 2 Tab, 30 Ref.

Descriptors: *Lakes, *Eutrophication, *Protozoa, *Zooplankton, Water pollution effects, Trophic level, Oligotrophic lakes, Mesotrophic lakes, Eutrophic lakes, *Florida, Biomass, Species composition.

The abundance, biomass, composition, and size distribution of planktonic ciliated protozoans were analyzed monthly during 1979 in 20 Florida lakes representing oligotrophic, mesotrophic, eutrophic, and hypereutrophic states. Abundance and biomass of the protozoans increased with increasing trophic state. Mean annual biomass was 9.3 + or - 5.6 mg C per cu m in the oligotrophic group, 126 + or - 89.2 C per cu m in the hypereutrophic group. Number of ciliates per ml increased from 10.8 + or - 5.4 in the oligotrophic group to 155 + or - 60.9 in the hypereutrophic group. Oligotrophic lakes were dominated by Oligotrichida; eutrophic lakes by Scuticociliatida, Oligotrichida, and Haptorida. Also found in significant abundance in the study were Prostomatida, Trichostomatida, Pleutostomatida, Peritrichida, and Hymenstonatida. Plagiopyla and Paramecium were found only in hypereutrophic lakes. As trophic state increased, the large-bodied ciliates (40-50 microns) were progressively replaced by small-bodied ciliates (20-30 microns), a direct of food availability. In oligotrophic lakes where bacterial concentrations were limiting, the small, bacteria-ingesting taxa were scarce and the larger-bodied taxa, able to eat nannoplankton, were present. (Cassar-FRC)
W83-00704

THE EFFECTS OF NUTRIENT, PH AND HERBICIDE LEVELS ON ALGAL GROWTH,
Langston Univ., OK.
B. Tubea, K. Hawxby, and R. Mehta.
Hydrobiologia, Vol 79, No 3, p 221-227, 1981. 8 Fig, 1 Tab, 19 Ref.

Descriptors: *Algal growth, *Agricultural chemicals, Herbicides, Hydrogen ion concentration, Water pollution effects, Nutrients, Dinoseb, Picloram, Fluometuron, Magnesium, Calcium, Phosphorus, Potassium, Algae, *Oklahoma.

Two levels of pH and several nutrient elements which occur in natural waters of rivers and lakes in Oklahoma were selected as variables to study the growth of algae. The elements selected as variables for the growth of algae were Ca, Mg, K, P, and N. Four herbicides, picloram, prometryn, dinoseb, and fluometuron, were added at concentrations of 0.1, 1.0 or 10.0 microM. Picloram did not cause any significant effect on the growth of Chlorella at the concentrations tested. However, the other herbicides tested produced various effects on algal growth. In summarizing the findings, prometryn and fluometuron at high concentrations were most effective for algaecide purposes. The 10 microM concentrations drastically reduced growth in both algae species. Dinoseb concentrations were much less effective than fluometuron or prometryn. Picloram produced no significant difference on growth rates of algae. Higher growth rates were obtained with high levels of N and pH in both algae. The two levels of K, Ca, and Mg used in this study produced no significant differences on growth rates of algae. Different levels of P also resulted in no significant differences in algal growth. Of the two algal species used in this study, Lyngbya appeared to be more susceptible to the herbicides tested. The study thus suggests that different herbicides have varying effects on the algae tested. The presence of these herbicides in natural aquatic systems could alter phytoplankton composition, depending on herbicide and mineral concentrations. (Baker-FRC)
W83-00707

RECORDS OF A LAKES' LIFE IN TIME: THE SEDIMENTS,
Freshwater Biological Association, Ambleside (England).
W. Pennington.
Hydrobiologia, Vol 79, No 3, p 197-219, 1981. 6 Fig, 1 Tab, 50 Ref.

Descriptors: *Lake sediments, *Limnology, *Eutrophication, Cores, Shallow water, Water pollution effects, Wastewater pollution, Ecosystems, Paleolimnology, Sediments, Lake morphology, Lakes, Lake District, *United Kingdom.

Evidence from sediment cores is used to identify various influences which caused changes in lakes of the English Lake District. Present differences in the lakes raise questions about their history during the 14,000 years since the end of the most recent glaciation. Radionuclide dating indicates an increase in the rate of sediment accumulation in all 14 of the lakes from 5,000 years ago. In the most unproductive lakes the depth-time-scale over the last 5000 years is almost linear, but all the productive lakes showed further acceleration of the rate of sediment accumulation as the mud-water interface was approached. The present rates of sediment accumulation are strongly correlated with biological productivity, whereas before 5000 B.P. (Before Present) there was little between-lake difference in sediment accumulation rates. Estimated annual deposition rates, through time, for microfossils and chemical variables are determined primarily by the changing rate of sediment accumulation, which far exceeds in amplitude the changes in proportional composition. The effects of climatic changes appear most clearly in the sediments of the period of deglaciation, 14,000-10,000 years ago. The increased rate of transfer of particles from catchments to lakes after 5,000 B.P. was accelerated further by the effects of man's disturbance of primary vegetation. Pollen evidence for deforestation invariably coincided with geochemical evidence for accelerated transfer of mineral soils to lakes. Towards the end of the early postglacial period the decline and disappearance of aquatic species of high base demand agreed with the concept of early period soil stability, intensive leaching, and high input to lakes of dissolved nutrients, followed by rapid soil erosion. From about 1000 years ago, the shallow lakes were seasonally anoxic, with a flora and fauna distinct from those of deeper lakes, though not fully 'eutrophic'. Enrichment due to human wastes from 1850 was followed by changes in biota in all affected lakes, but only in shallow lakes have these changes progressed to true eutrophication. (Baker-FRC)
W83-00708

VARIABLE EFFECTS OF SEDIMENT ADDITION ON STREAM BENTHOS,
North Carolina Div. of Environmental Management, Raleigh.
For primary bibliographic entry see Field 4C.
W83-00730

EFFECT OF THERMAL EFFLUENTS ON OLIGOCHAETES IN KEOWEE RESERVOIR, SOUTH CAROLINA,
Fish and Wildlife Service, Clemson, SC. Southeast Reservoir Investigations.
S. J. Nichols.
Hydrobiologia, Vol 79, No 2, p 129-136, 1981. 2 Fig, 3 Tab, 22 Ref.

Descriptors: *Thermal pollution, *Oligochaetes, *Population dynamics, Reservoirs, Powerplants, Nuclear powerplants, Heated water, Naididae, Tubificidae, Seasonal variation, Keowee Reservoir, *South Carolina, Littoral zone, Oligotrophy.

Keowee Reservoir, an oligotrophic impoundment in the Piedmont Region of northwestern South Carolina, served as a study site to determine the impact of the Oconee Nuclear Station on oligochaetes in the reservoir water. Benthos samples were taken between April 1974 and October 1975. A total of 24 oligochaete species, including 18 Naididae, were identified. The average density in the reservoir was 2427 per sq m. In early fall, winter and late spring the discharge water temperatures were as much as 6.6C higher than average reservoir temperatures and formed an epilimnetic plume that was thermally traceable 10 km into the north basin and 3.5 km into the south basin. During the summers of both 1974 and 1975 there was no heated plume due to hypolimnetic withdrawal. The summer discharge water temperatures were similar to average reservoir temperature or as much as 3.8C lower. This cool summer plume extended only 0.5 km from the point of discharge or less than 10% of the distance covered by the winter plume. Operation of the nuclear station not only increased water temperatures in the discharge cove during certain periods of the year, but it also concentrated zooplankton, added large amounts of hypolimnetic water, and increased the rate of water flow. However, operation of the plant apparently influenced oligochaetes only in the immediate vicinity of the power plant, an area less than 5% of the total reservoir surface, and in 1974 and 1975 this influence was observed as a stimulated population growth. (Baker-FRC)
W83-00731

NUTRIENTS AND PHYTOPLANKTON IN THREE SHALLOW, FRESH-WATER LAKES OF DIFFERENT TROPHIC STATUS IN WESTERN AUSTRALIA,
Western Australia Univ., Nedlands. Dept. of Botany.
D. M. Gordon, C. M. Finlayson, and A. J. McComb.
Australian Journal of Marine and Freshwater Research, Vol 32, No 4, p 541-553, 1981. 4 Fig, 3 Tab, 20 Ref.

Descriptors: *Lakes, *Trophic level, *Nutrients, *Phytoplankton, *Australia, Loch McNess, Lake Joondalup, Lake Monger, Shallow water, Water depth, Eutrophic lakes, Eutrophication, Nitrogen, Phosphorus, Population dynamics, Algae, Diatoms, Seasonal variation, Water properties, Conductivity, Ammonia, Nitrogen compounds, Temperature effects, Water temperature, Light penetration, Hydrogen ion concentration.

The trophic status of three lakes situated on the coastal plain near Perth, Western Australia was assessed. These lakes represent a series of shallow lakes which lie in an ancient dune system containing limestone. Loch McNess lies in a National Park. Lake Joondalup is in an area becoming urbanized. Lake Monger is in a suburb near the center of Perth. Phytoplankton numbers and environmental parameters were measured monthly, including forms of nitrogen and phosphorus present. Populations tended to be high when water levels in the lakes were low. Phytoplankton numbers were dominated by blue-green algae in summer in each lake, with the lowest numbers occurring in Loch McNess. Green algae were most prominent in

autumn and winter. Diatoms were present at relatively lower numbers thoughout the year. Phytoplankton numbers were strongly correlated with phosphorus levels, particularly for blue-green algae, and less so with nitrogen. Green algae were also strongly correlated with water conductivity. Nearly 80% of the variance in phytoplankton numbers was accounted for in a multiple linear regression presentation by temperature, sunlight hours, depth, pH, and conductivity, as well as phosphate, organic phosphorus, ammonia, nitrate-nitrite, and organic nitrogen concentrations. Much of the variance was accounted for by the nutrients alone. Comparisons with literature data suggest that Lakes Joondalup and Monger are eutrophic by world standards, and are far more eutrophic than Loch McNess. (Baker-FRC)
W83-00739

STATUS OF AQUATIC MACROPHYTES IN AN UNDRAINED AREA OF FEN IN THE NORFOLK BROADS, ENGLAND,
Sheffield Univ. (England). Dept. of Botany.
B. D. Wheeler, and K. E. Giller.
Aquatic Botany, Vol 12, No 3, p 277-296, 1982. 4 Fig, 5 Tab, 36 Ref.

Descriptors: *Aquatic plants, *Fens, *England, *Macrophytes, Wetlands, Bogs, Chemical composition, Sodium, Phosphorus, Nitrates, Nitrogen, Nutrients, Peat bogs, Peat, Aquatic life, Water analysis, Sediments.

The many types of aquatic vegetation present in the undrained fen in Broadland, Norfolk were identified and studied, with particular reference given to the chemical features of the localities of the plant communities. In recent years there has been a considerable loss both in number and in species differences among the plants in this area. Currently three main types of vegetation were identified: an Elodea-Potamogeton crispus community, a Ceratophyllum-Stratiotes community, and a Utricularia vulgaris community. The first two communities occur near the land margins of the fens and the last one mainly on the deep peat in the central areas. Most luxuriant macrophyte growth was observed at the fen margins where levels of nitrate-nitrogen, derived from land drainage, were higher than in the central areas of the fen. The increased nitrate-nitrogen concentration was noted both in water and in sediment samples. Preliminary comparisons were made of some chemical characteristics of the water and sediments of sites with a well developed macrophyte vegetation with other areas lacking such a development. Sites poor in macrophytes had higher levels of sodium in water and sediments and also more strongly reducing sediments than those in a rich macrophyte vegetation area. However, measured levels of dissolved inorganic nitrogen and soluble reactive phosphorus were lower, or not significantly different. A recent reduction in the amount of Stratiotes aloides in some dykes may be related to nutrient improverishment rather than enrichment. (Baker-FRC)
W83-00746

CILIATED PROTOZOA AND WATER QUALITY IN THE TORRENTE STIRONE (NORTHERN ITALY),
Parma Univ. (Italy). Lab. di Ecologia.
P. Madoni, and P. F. Ghetti.
Acta Hydrobiologica, Vol 23, No 2, p 143-154, 1982. 3 Fig, 4 Tab, 38 Ref.

Descriptors: *Protozoa, Water quality, Seasonal variation, Classification, Water pollution effects, Torrente Stirone, *Italy, Rivers, Saprobic index, *Ciliates, *Bioindicators.

Ciliated protozoa were surveyed at 14 sites in the Torrente Stirone and tributaries in northern Italy to classify the fauna, compare water quality, and test the effectiveness of using ciliated protozoa as indicators of saprobity. Some of the 114 species identified were common to all stations. The most important widespread species were Trachelophyllum pusillum, Coleps hirtus, Chilodonella cucullulus, Glaucoma scintillans, Dexiotricha colpidiopsis, Uronema nigricans, Cinetochilum margaritaceum, Cyclidium glaucoma, Holosticha viridus, Aspidisca costata, and Euplotes patella. Seasonal variations in numbers and species of protozoa were observed. Numbers of individuals and species were lowest in January and highest in summer. Oligo- and polysaprobic components of the protozoan community showed much wider fluctuations with water quality than the alpha- and beta-mesosaprobic components. During the summer the alpha-m esosaprobic component was dominant and had fairly high, uniform values, making it less appropriate than the oligo- and polysaprobic components for reflecting the pollutant load. In this river larger proportions of poly- and alpha-mesosaprobic ciliates were associated with poor water quality stations, whereas larger proportions of oligo- and beta-mesosaprobic ciliates were associated with water of better quality. (Cassar-FRC)
W83-00749

REDUCTION OF TOXICITY AND MUTAGENICITY OF CHLORINATION EFFLUENTS WITH SULPHUR DIOXIDE,
C.I.L. Inc., Mississauga (Ontario). Chemicals Research Lab.
For primary bibliographic entry see Field 5D.
W83-00764

PRIMARY PRODUCTION IN THREE LAKES OF DIFFERING SALINITY IN VICTORIA, AUSTRALIA,
Avondale Coll., Cooranbong (Australia). Dept. of Sciences.
For primary bibliographic entry see Field 2H.
W83-00775

BACTERIAL FLORA OF THE WATER AND SEDIMENT IN THE EDO RIVER MOUTH (IN JAPANESE),
Nihon Univ., Tokyo (Japan). Dept. of Fisheries.
H. Sugita, H. Tanaami, T. Kobashi, and Y. Deguchi.
Japanese Journal of Limnology, Vol 43, No 1, p 27-34, January, 1982. 2 Fig, 6 Tab, 14 Ref. English summary.

Descriptors: *Bacteria, *Rivers, Sediments, Water analysis, Bacillus, Clostridium, Acinetobacter, Moraxella, Pseudomonas, Flavobacterium, Vibrio, Aeromonas, Seasonal variations, Anaerobic conditions, Aerobic conditions, Limnology, Bottom sediments, *Japan, Edo River.

The highly polluted mouth of the Edo River was studied from May of 1980 through March of 1981 for bacterial flora in the water and sediment. Six different agar media were used aerobically and anaerobically in the investigations. The anaerobic water mass, called 'Aoshio', had a depth of 10 to 15 meters from May to July. Total viable counts in the water column ranged from 1000 to 100,000/ml, and aerobic gram-negative bacteria, Acinetobacter, Moraxella, Pseudomonas, Flavobacterium and Vibrio-Aeromonas, were vertically, horizontally, and seasonally predominant. In spite of the anaerobic condition of bottom water samples, few anaerobes and many aerobes were isolated from water samples taken in May and July. In the sediment samples total viable counts were 1,000,000/g, and aerobic gram-negative bacteria and spore-formers, Bacillus and Clostridium, were seasonally predominant. The presence of aerobes in the anaerobic water layer and bottom sediment suggests their sedimentation from the upper layer. (Baker-FRC)
W83-00781

EFFECTS OF STREAM-CROSSING BY A PIPELINE ON THE BENTHIC MACROINVERTEBRATE COMMUNITIES OF A SMALL MOUNTAIN STREAM,
Mobil Oil Canada. Ltd., Calgary (Alberta).
P. T. P. Tsui, and P. J. McCart.
Hydrobiologia, Vol 79, No 3, p 271-276, 1981. 1 Fig, 4 Tab, 4 Ref.

Descriptors: *Pipelines, *Benthic environment *Streams, *Water quality, Sedimentation, Silt, Water pollution effects, Aquatic life, Environmental effects, Rivers, Macroinvertebrates.

The impact on an equatic environment was studied at Archibald Creek, British Columbia, for a two year period where a pipline crosses a stream. Water chemistry and benthic macroinvertebrates were used as monitoring tools. The macroinvertebrates were sampled from 4 stations. Station 1 was located 40 m upstream of the pipeline crossing while stations 2, 3, and 4 were 10, 75, and 100 m downstream of the crossing. The creek was crossed by the pipeline on September 19, 1974. Trenching was done with a hydraulic hoe. Materials removed from the stream bed were deposited upstream, alongside the trench. The stream bottom at station 1 remained clean. Station 2 experienced an extensive accumulation of silt and sand to the stream bed. At station 3 there was a deposition of fine material 20-50 mm deep over most of the stream bed. Station 4 remained relatively clean with a thin coating of less than 1 mm silt in some areas. On November, 1974 there was no noticeable sedimentation at station 1. Silt and sand still covered the bottom at station 2, 10-20 mm deep. At station 3 silt covered most of the rocks up to 1 mm in depth. At station 4 only slight evidence of sedimentation was found. On October 30, 1976 there were no signs of sedimentation at any of the sampling stations. Substantial reduction of benthic standing crop was noted at downstream stations, up to 74% reduction in winter at station 2. Standing crop data from October 1976 also indicated a recovery trend in the benthic communities at downstream stations. Thus while both water quality and benthic communities were affected by stream crossing of the pipeline, both effects were short term and nonresidual. (Baker-FRC)
W83-00789

ASPECTS OF THE BIOLOGY OF ESTUARINE FISH POPULATIONS SAMPLED FROM POWER STATION TRASH SCREENS,
City of London Polytechnic (England). Dept. of Biological Sciences.
W. L. F. Van Den Broek.
International Journal of Environmental Studies, Vol 15, No 3, p 203-216, 1980. 6 Fig, 3 Tab, 16 Ref.

Descriptors: *Fish populations, *Seasonal variation, *Migration, *England, Medway Estuary, Estuaries, Flounder, Plaice, Sprats, Fish migration, Species distribution, Growth rates.

The fish populations in the Medway, England, estuary were sampled monthly between 1973 and 1975 by collecting samples at power station trash screens. In all 59 species, including 30 not previously recorded in this estuary, were taken. Sprats and 13 other species formed more than 90% of the catch in all but 3 months of the study. Species numbers were lower in summer and higher in autumn and winter. A model of fish migration patterns was constructed from the seasonal distributions and length-frequency changes in consecutive months. For most fish species emigration and immigration were separated by 1 or more months between spring and autumn; in clupeoids emigration and immigration occurred coincidentally during spring and summer. The growth of first year plaice and flounder was studied, and length-weight regression equations were prepared. Growth rates in the September-February winter season were about half of the rest of the year. Little of the underlying causes for fish movement or the reasons for changes in growth rates were revealed. (Cassar-FRC)
W83-00802

ECOLOGICAL EFFECTS OF MINE EFFLUENTS ON THE SOUTH ESK RIVER, NORTH-EASTERN TASMANIA, II. TRACE METALS,
Canberra College of Advanced Education (Australia).
For primary bibliographic entry see Field 5B.
W83-00832

NUTRIENT RETENTION AND MACROINVERTEBRATE COMMUNITY STRUCTURE IN A SMALL STREAM RECEIVING SEWAGE EFFLUENT,

Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Biology.
P. F. Kondratieff, and G. M. Simmons, Jr.
Archiv fur Hydrobiologie, Vol 94, No 1, p 83-98, April, 1982. 7 Fig, 2 Tab, 33 Ref.

Descriptors: *Nutrients, *Phosphate, *Organic carbon, Water pollution effects, Particulate matter, Macroinvertebrates, Invertebrates, Wastewater disposal, Self-purfication, Species distribution, Streams, *Virginia, Cedar Run.

Retention of phosphorus and organic carbon was studied in Cedar Run, Virginia, a second order stream which receives 1136 cu m per day of secondary effluent from a wastewater treatment plant. Of the total phosphate determined at different stations, the orthophosphate component was 18% at an unimpacted reference site and 67% at the outfall, leveling off at 50% by the farthest downstream station sample, 4 km from the sewage plant. Therefore, a proportion of the added phosphate was retained in the stream in dynamic equilibrium with substrates and biota. Excess phosphate was removed by streamflow. Concentrations of orthophosphate (mg per liter) were zero at the reference site and 3.5 at the outfall, decreasing to 0.5 at the farthest downstream site. Total phosphate concentrations (mg per liter) were about 0.1 at the reference site, 7 at the outfall, and 1.2 at the farthest downstream site. Concentrations of particulate organic carbon (POC) in mg per liter varied from 0.5 at the reference site and the farthest downstream site to 5.8 at the outfall. The proportions of POC to total organic carbon were 14% at the reference site and the farthest downstream site, 43% at the outfall. Apparently all the excess POC was either converted to a dissolved or inorganic form or was retained within the system. Macroinvertebrate density peaked at about 3 km from the outfall. However, diversity was significantly affected by the effluent and did not return to reference levels in the reach studied. Although balanced, pollution sensitive communities were found at the reference site, the communities below the outfall were dominated by large numbers of individulals from 3-4 pollution tolerant species. (Cassar-FRC)
W83-00844

LONG-TERM VARIATION OF MACROINVERTEBRATE ASSEMBLAGES IN APALACHEE BAY, FLORIDA,
Florida State Dept. of Environmental Regulation, Tallahassee.
P. J. Dugan, and R. J. Livingston.
Estuarine Coastal and Shelf Science, Vol 14, No 4, p 391-403, April, 1982. 3 Fig, 7 Tab, 31 Ref.

Descriptors: *Macroinvertebrates, *Temporal distribution, *Estuaries, Estuarine environment, Gulf of Mexico, Gulfs, Water pollution effects, *Apalachee Bay, Crustaceans, *Florida, Decapods, Biomass, Species diversity, Species composition, Population density, Sea grasses.

The impact of pulp mill effluents on the estuarine biota of Apalachee Bay was investigated. Trawlable epibenthic macroinvertebrates were samples monthly from July 1972 to May 1979. Decapod crustaceans comprised 95% of the total number of individuals collected. The relative abundance of dominant species and species richness in the two estuaries, one polluted and the other non-polluted, were similar, although the numbers of individuals collected in the unpolluted Econfina area was always at least twice that taken in the Fenholloway area. This was attributed to the greater seagrass biomass in the Econfina estuary. Comparisons of the constancy of species composition over the 7-year period and species rank changes following a pollution abatement program in the Fenholloway system indicated enhanced species persistence in the unpolluted area. Overall, despite considerable seasonal variability of physico-chemical and biological characteristics, there was long-term stability of key invertebrate populations in the unpolluted estuarine system. (Baker-FRC)
W83-00845

LIMNOLOGY OF A EUTROPHIC RESERVOIR: BIG BEAR LAKE, CALIFORNIA,
New York State Museum, Albany.
C. A. Siegfried, P. L. Herrgesell, and M. E. Kopache.
California Fish and Game, Vol 68, No 2, p 90-108, April, 1982. 11 Fig, 3 Tab, 26 Ref.

Descriptors: *Limnology, *Lakes, *Eutrophication, Nutrients, Phosphorus, Nitrogen, Seasonal variation, Algae, Algal growth, Phytoplankton, Temperature effects, Water temperature, Reservoirs, *Big Bear Lake, *California, Trophic level, Stratification.

Big Bear Lake, originally constructed for storage of irrigation water for the Redlands-San Bernardino area of southern California, but now chiefly used for recreation, is experiencing rapid eutrophication. The current limnologic study was initiated to establish a data base for the evaluation of lake restoration options. The study covered 2 years with significantly different meterological conditions. The major source of water for the Lake is runoff, including snowmelt. The average seasonal precipitation in the drainage area is 61 cm, but varies from 96.5 cm at the dam to 31 cm at the east end of the lake. The lake surface freezes during most winters. The lake stratifies in early spring, and surface temperatures reach about 22 C by midsummer. Complete mixing occurs by September. Anoxia develops in the hypolimnion during stratification, including internal nutrient loading from sediments. The annual phytoplankton cycle peaks in the spring and late summer. Diatoms dominate in early spring, green algea briefly dominate in early summer, and blue green algae dominate from mid-summer to fall. Phosphorus and nitrogen loads from tributaries draining the urbanized southeast portion of the drainage are disproportionately high. Nutrient loading rates are excessive and well into the eutrophic range. Trophic status was similar in both years. Big Bear Lake will probably remain eutrophic because of its shallow morphology, high nutrient content, and basin orientation and development. (Baker-FRC)
W83-00846

COPPER, ZINC, AND CADMIUM CONCENTRATIONS OF RESIDENT TROUT RELATED TO ACID-MINE WASTES,
California Dept. of Fish and Game, Redding.
For primary bibliographic entry see Field 5B.
W83-00862

SOCIOECONOMIC VALUE OF THE TROUT FISHERY IN LAKE TANEYCOMO, MISSOURI,
Missouri Dept. of Conservation, Columbia.
For primary bibliographic entry see Field 6C.
W83-00872

THE RELATION BETWEEN FISHERIES MANAGEMENT AND LIMNOLOGY,
McGill Univ., Montreal (Quebec), Dept. of Biology.
F. H. Rigler.
Transactions of the American Fisheries Society, Vol 111, No 2, p 121-132, March, 1982. 45 Ref.

Descriptors: *Limnology, *Fisheries, Fish ponds, Fishkill, Lakes, *Fish management, Fish farming, Scientific personnel, Eutrophication, Theorectical analysis.

Improved communication between the two disciplines of fisheries management and limnology is sought in this article. The conflicting pradigm theories that currently inhibit communication between limnologists and fisheries biologists are decribed, and alternative approaches are offered which could unite the disciplines. The fisheries biologists addressed in this communication are those whose primary goal is the prediction of the future size and yield of fish stocks as they are influenced by changing climate fishing pressures, and other anthropogenic stresses. Limnologists sharing this view are those concerned with nutrients, pollutants, energy flow, and populations or communities of aquatic decomposers, plants, or invertebrates. It is argued that the underlying cause of the schism is that limnologists and fisheries biologists do not share the same paradigm theory about the functioning of aquatic ecosystems. Communication would be improved by a common paradign. It is suggested that a minority approach, here called empiricism, is common to both disciplines and should be encouraged. Past attempts to employ the empircal approach to fisheries engineering have included attempts to predict sustainable fish yields from lake depth and chemistry and attempts to predict and prevent occurrence of algal blooms and fishkill in prairie ponds. (Baker-FRC)
W83-00873

USE OF FISH VENTILATION FREQUENCY TO ESTIMATE CHRONICALLY SAFE TOXICANT CONCENTRATIONS,
Corvallis Environmental Research Lab., OR.
M. A. Cairns, R. R. Garton, and R. A. Tubb.
Transactions of the American Fisheries Society, Vol 111, No 1, p 70-77, January, 1982. 1 Fig, 2 Tab, 40 Ref.

Descriptors: *Water pollution effects, *Fish, *Zinc, Metals, Heavy metals, Toxicity, Ventilation, *Steelhead, Frequency analysis, Mathematical studies, Estimating.

The effect-no-effect concentrations of zinc were determined for steelhead Salmo gairdneri based on ventilation rate monitoring. A system was devised to expose steelheads to zinc solutions in flow-through chambers so that venilatory patterns could be measured with external electrodes. The system was evaluated for two steelhead strains under varying conditions of temperature (7, 12, and 17C) and hardness (25 and 125 mg/liter as CaC03). Ventilation frequencies enumerated from bioelectric potentials at the highest test concenrations in five of 10 tests. At 12C and 25 mg/liter hardness, responses were detected at a zinc concentration of 144 micrograms/liter; the 'safe' concentration determined in a chronic exposure to embroys and juveniles was between 444 and 819 micrograms zinc/liter. This indicates that ventilation frequency tests are at least as sensitive as long-term toxicity tests and may be used to screen chemicals for potential harmful effects on fish. (Baker-FRC)
W83-00892

HEAVY METALS POLLUTION OF THE UPPER ARKANSAS RIVER, COLORADO, AND ITS EFFECTS ON THE DISTRIBUTION OF THE AQUATIC MACROFAUNA,
Bureau of Reclamation, Denver, CO. Engineering and Research Center.
R. A. Roline, and J. R. Boehmke.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-111369, Price codes: A05 in paper copy, A01 in microfiche. Report REC-ERC-81-15, September 1981. 76 p, 21 Fig, 6 Tab, 173 Ref, 1 Append.

Descriptors: *Heavy metals, *Water pollution effects, *Aquatic animals, *Water quality, *Arkansas River, *Colorado, Limnology, Invertebrates, Fish populations, River flows, Stream pollution, Diversion.

A limnology study was done on a 30 km section of the upper Arkansas River, to determine the effects of heavy metals pollution on the distribution of the aquatic macrofauna. Physical and chemical water parameters were measured, aquatic macroinvertebrates were collected, and fish populations at selected stations were evaluated to determine density and heavy metal content of tissue. Historically, river flows which dilute heavy metal concentrations were not as high as those occurring since transmountain diversions began, so it is possible that heavy metal concentrations in the river were greater in the past. However, water quality, species diversity of aquatic macroinvertebrates, fish populations, and metal accumulation in fish tissue show that heavy metal pollution of the upper Arkansas River near Leadville, Colorado, is presently very severe. Conditions for aquatic life are generally poor even though physical parameters and major ion concentrations are adequate for the survival of most aquatic organisms. Heavy-metal-laden inflows adversely affect water quality and thus the aquatic animal populations, while freshen-

ing inflows improve water quality and, therefore, conditions for the aquatic fauna. The major sources of heavy-metal-laden inflows are the Leadville Drainage Tunnel, California Gulch, and a number of intermittent flows entering between Lake Fork and Lake Creek. Important freshening flows are Tennessee Creek, Lake Fork (containing Halfmoon Creek), and Lake Creek. It is highly probable that a substantial reduction or elimination of any of these freshening inflows will result in a degradation of water quality and adversely affect the aquatic organisms. (Author's abstract)
W83-00921

THE CATION DENUDATION RATE AS A QUANTITATIVE INDEX OF SENSITIVITY OF EASTERN CANADIAN RIVERS TO ACIDIC ATMOSPHERIC PRECIPITATION,
Canadian Centre for Inland Waters, Burlington (Ontario).
M. E. Thompson.
Water, Air and Soil Pollution, Vol 18, No 1-3, p 215-226, 1982. 7 Fig, 1 Tab, 6 Ref.

Descriptors: *Rivers, *Cations, *Watersheds, Precipitation, Seasonal variation, Nova Scotia, Newfoundland, Model studies, Chemical composition, Hydrogen ion concentration, Runoff, Air pollution, *Acid rain.

A model was developed to correlate the cation denudation rate (CDR) of a watershed, the atmospheric load of excess sulfate ion, and the pH of the river. The CDR is defined as the rate that cations derived from chemical weathering are carried off by runoff. Chemical and discharge data for rivers in Nova Scotia and Newfoundland were used to develop and test the model, which is based on the common major ion chemistry of soft surface waters. As a concentration model it can be used as a test of data quality or as a display of the current status of lakes. As a rate model it can be used to establish acceptable rates of acid loading based on minimum acceptable levels of pH that can be tolerated by the biota. The effect of seasonal patterns of rainfall, discharge and duration of snowpack on the annual pH cycle of one river suggests that permissible loadings should be defined by season as well as by amount. (Baker-FRC)
W83-00955

BIOLOGICAL, CHEMICAL AND PHYSICAL RESPONSES OF LAKES TO EXPERIMENTAL ACIDIFICATION,
Department of Fisheries and Oceans, Winnipeg (Manitoba). Freshwater Inst.
D. W. Schindler, and M. A. Turner.
Water, Air, and Soil Pollution, Vol 18, No 1-3, p 259-271, 1982. 4 Fig, 6 Tab, 29 Ref.

Descriptors: *Lakes, *Acid rain, *Water pollution effects, *Physical properties, *Chemical properties, *Biological properties, Transparency, Hypolimnion, Thermoclines, Nitrogen, Iron, Manganese, Zinc, Sodium, Aluminum, Chlorophyll, Chlorophyta, Chrysophyta, Algae, Fish, Sulfur.

Work is summarized on biological, physical and chemical changes which occur early in the experimental acidification of a small lake. Examples of interaction are offered. The acidification was carried out over a 5 year period, and data collected are compared to a two year pre-acidification stage. Significant changes included increased transparency, rates of hypolimnion heating and rates of thermocline deepening; increased concentrations of Mn, Na, Zn, Al, and chlorophyll; decreased concentrations of suspended C, total dissolved N, Fe and chloride; increases in Chlorophyta but decreases in Chrysophyta; the disappearance of the opossum shrimp Mysis relicta and the fatheat minnow Pimephales promelas; the appearance of epidemics of the filamentous alga Mougeotea; decreased fitness and decline in numbers of Orconectes virilis; and increased embryonic mortality of the lake trout Salvelinus namaycush. Sulfur budgets for two lakes experimentally acidified with sulfuric acid revealed that an average of 1/4 to 1/3 of added sulfate is sedimented, presumably as FeS, reducing the efficiency of acidification. The sedimentation occurs under both oxic and anoxic conditions. The utility of whole-ecosystem mass balance studies of S in experimental and observational mass balance studies is discussed. (Baker-FRC)
W83-00957

ACIDIFICATION OF NOVA SCOTIA LAKES I: RESPONSE OF DIATOM ASSEMBLAGES IN THE HALIFAX AREA,
Department of the Environment, Halifax (Nova Scotia).
H. H. Vaughan, J. K. Underwood, and J. G. Ogden, III.
Water, Air, and Soil Pollution, Vol 18, No 1-3, p 353-361, 1982. 4 Fig, 9 Ref.

Descriptors: *Lakes, *Air pollution, *Acidity, *Acid rain, Algae, *Diatoms, *Lake sediments, Water pollution effects, Water pollution sources, *Nova Scotia.

A comparison was made of diatom remains in surficial lake sediments collected in 1971 and 1980. Data from the four lakes studied reveals that all lakes have undergone similar and pronounced shifts in diatom assemblages. The percentages of alkaliphilous species have fallen since 1971, while acidophilous species have increased. These systematic shifts have occurred in spite of the fact that the four lakes are measurably different in almost every respect. These shifts may be ascribed to the influx of air-borne pollutants as supported by chemical results of lacustrine and precipitation samples collected in the Halifax area. Local rates of acidification are stressing the basic biological components of lacustrine systems to the point where such changes are taking place. If deposition of acids in Nova Scotia increases in the future, it may result in relatively excessive effects on lacustrine biological communities. (Baker-FRC)
W83-00960

EFFECTS OF EXPERIMENTAL ACIDIFICATION ON MACROINVERTEBRATE DRIFT DIVERSITY IN A MOUNTAIN STREAM,
Cornell Univ., Ithaca, NY. Div. of Biological Sciences.
R. J. Hall, J. M. Pratt, and G. E. Likens.
Water, Air, and Soil Pollution, Vol 18, No 1-3, p 273-287, 1982. 1 Fig, 4 Tab, 39 Ref.

Descriptors: *Water pollution effects, *Acid rain, Drift, *Macroinvertebrates, Acid streams, Acidic water, Snowmelt, Mountains, Atmosphere, Air pollution.

The response of macrobenthic invertebrates to elevated hydrogen ion stress as reflected by changes in the rate at which these organisms move downstream and by corresponding changes in the diversity of such drift was investigated. The pH of the stream water in the treatment section was maintained near 4.0 by continuously adding dilute concentrations of sulfuric acid for about 5 months. Stream water pH was measured routinely 12 m below and 5 m above the acid addition point. The rate of movement of individuals and genera was significantly greater for those organisms leaving the acid-stressed area during the first five days than for those entering, whereas no differences between the rate of macroinvertebrates entering or leaving the acid-stressed area were apparent for either numbers or genera over the remaining 25-day study period. The effect of increased hydrogen ion concentration stress was not apparent upon calculating and comparing only the generic diversities of drift samples from above and below the experimental acidification. A clearer interpretation of the effects of elevated acidity was conveyed by analyzing diversity in relation to phylogenetic and functional classifications. The most useful measures concerning the significant effects of stream acidification on macroinvertebrate community structure and function were changes in total numbers of individuals, generic richness, evenness and the generic diversities of individual functional groups. (Baker-FRC)
W83-00967

CONCEPTS FOR THE MODELLING OF THE PHOSPHORUS CYCLE IN LAKES AND RESERVOIRS (MODELLVORSTELLUNGEN UBER DEN PHOSPHORKREISLAUF IN STEHENDEN GEWASSERN),
Eidgenoessische Anstalt fuer Wasserversorgung, Abwasserrenigung und Gewaesserschutz, Zurich (Switzerland).
D. M Imboden.
Zeitschrift fur Wasser und Abwasser Forschung, Vol 15, No 3, p 89-95, June 1982. 6 Fig, 3 Tab, 9 Ref. English summary.

Descriptors: *Phosphorus, *Standing waters, *Model studies, *Eurtophication, *Limiting nutrients, Nutrients, Photosynthesis, Respiration, Primary productivity, Phytoplankton, Lakes, Reservoirs, Mixing, Ecological effects, Mineralization, Cycling nutrients.

Models for the phosphorus (P) cycle in standing waters are discussed with the aim of providing the reader with concepts to simplify the representation of a complex system. Models of the P cycle are of particular interest because of the key role of P as a limiting nutrient, in eutrophication i.e., limiting phytoplankton growth by being the first nutrient to be completely used up by phytoplankton. The linear 1-box model is the most popular and describes the P cycle in terms of mass balance. One way of refining this model is to introduce the concept of chemical-biological transformations. Dissolved P should be differentiated from particulate P, the former being identified with phosphate and the latter with biomass-incorporated P; this means that the transformation of the former to the latter indicates photosynthesis, while transformation of the latter to the former indicates respiration. The ecological model takes into account competition between different kinds of plankton, energy and mass flow in the food chain, and chemical-biological interactions. Another way of refining the 1-box model is to introduce the concept of area structure within the lake, e.g., to take into account the different P concentrations in the hypolimnion and epilimnion. Mixing processes in the lake and lake-sediment interaction are included. In general, the complexity of the model should not be grater than that of available field data and should be compatible with the complexity of the problem being addressed. Every model has a list of assumptions which must be fulfilled by the lake to be modeled. A model calibrated for a specific lake condition must not be used to predict a condition far removed from the calibrated condition. (Gish-FRC)
W83-00971

OPEN OCEAN DISPOSAL OF MATERIALS DREDGED FROM A HIGHLY INDUSTRIALIZED ESTUARY: AN EVALUATION OF POTENTIAL LETHAL EFFECTS,
Old Dominion Univ., Norfolk, VA. Dept. of Biological Sciences.
For primary bibliographic entry see Field 5E.
W83-01030

5D. Waste Treatment Processes

STABILIZATION OF WASTE-ACTIVATED SLUDGE THROUGH THE ANOXIC-AEROBIC DIGESTION PROCESS,
Osaka Univ. (Japan). Dept. of Environmental Engineering.
For primary bibliographic entry see Field 5E.
W83-00713

REDUCTION OF TOXICITY AND MUTAGENICITY OF CHLORINATION EFFLUENTS WITH SULPHUR DIOXIDE,
C.I.L. Inc., Mississauga (Ontario). Chemicals Research Lab.
G. P. Donnini.
Pulp and Paper Canada, Vol 82, No 11, p 106-111, November, 1981. 4 Fig, 9 Tab, 18 Ref.

Descriptors: Sulfur dioxide, *Toxicity, *Pulp and paper industry, *Chlorination, Mutagens, Water pollution effects, Daphnia, Kraft mill wastes, Bleaching wastes, Wastewater treatment.

Spent liquor from the first stage in kraft pulp bleaching, the chlorination stage, displays considerable mutagenic activity in the Ames Salmonella mutagenicity test. The ecological significance of the mutagenicity is currently unknown. Three methods are currently known for simultaneously reducing toxicity and mutagenicity of chlorination effluents: raising the pH into the alkaline region, substituting chlorine dioxide for the chlorine used in bleaching, and treating the effluent with sulfur dioxide. The present study was initiated to establish optimum parameters for SO2 treatment of chlorination wastewaters and to detemine treatment costs. The Ames mutagenic activity and toxicity to Daphnia of laboratory- and mill-produced kraft chlorination effluents were greatly reduced by adding sulfur dioxide at levels of 0.02% at pH 5.5 or higher. Reductions in mutagenicity varied with the effluent tested; many were in the range of 70-90%. The interaction between mutagenic compounds present in chlorination effluent and bisulfite or SO2 was very rapid. Daphnia toxicity was reduced by half in many cases. Adding gaseous sulfur dioxide to limed kraft acid bleach effluent would cost about $0.60 per ton of unbleached pulp. (Cassar-FRC)
W83-00764

DESIGN OF COMBINED NITRIFICATION-DENTRIFICATION PLANTS (BEMESSUNG VON KOMBINIERTEN NITRIFIKATIONS- UND DENITRIFIKATIONSANLAGEN),
Technical Univ. of Denmark, Lyngby.
M. Henze, and E. Bundgaard.
Gas-Wasserfach Wasser-Abwasser, Vol 123, No 5, p 240-246, May 1982. 9 Fig, 4 Tab, 12 Ref. English summary.

Descriptors: *Nitrification, *Denitrification, *Design criteria, *Wastewater facilities, Wastewater treatment, Nitrogen removal, Carbon, Nitrogen, Phosphorus, Sludge, Sludge age, Activated sludge, Aerobic conditions, Temperature, Biological oxygen demand, Sedimentation basins, Basins.

The design of combined nitrification-denitrification plants for the treatment of wastewater is significantly more complicated than that of traditional biological facilities. In view of this, some of the basic theories of this process are discussed, together with their application to plant design. The theory of denitrification is described under the headings of carbon/nitrogen ratio, denitrification rate, and combined (nitrification-denitrification) process. It is concluded that design must be carried out taking each part of the process into account separately, since, on the whole, they proceed separately, although a certain amount of denitrification may occur in aerobic periods. Nitrification is dependent upon aerobic sludge age, and sludge loading cannot be used as a design parameter as it is in nitrification plants. The denitrification rate is dependent upon the carbon source and should be calculated on the basis of the concentration of organic dry matter and not on the basis of dry matter concentration. The design of the combined process rests on certain characteristics of the wastewater (wastewater volume, BOD in inflow, minimum temperature, total nitrogen in discharge) and process constants (aerobic sludge age, sludge production, holding time, denitrification rate, carbon/nitrogen ratio, sludge nitrogen content). Design is in six steps: calculation of sludge production, calculation of nitrogen level for denitrification, testing of carbon/nitrogen ratio, and calculation of basin volumes for nitrification, denitrification, and sedimentation. (Gish-FRC)
W83-00786

OXYGEN CONCENTRATIONS AND ELIMINATION OF INORGANIC PHOSPHORUS AND NITROGEN IN AN EXPERIMENTAL WATERCOURSE STOCKED WITH EMERGENT MACROPHYTES,
Oldenburg Univ. (Germany, F.R.) Dept. of Biology.
G. P. Zauke, D. Thierfeld, and T. Hopner.
Aquatic Botany, Vol 13, No 3, p 339-350, July, 1982. 3 Fig, 4 Tab, 33 Ref.

Descriptors: *Nutrient removal, *Machrophytes, *Watercourse, Nitrogen removal, Phosphorus removal, Phosphates, Tertiary wastewater treatment, *Wastewater treatment, Aquatic plants, Dissolved oxygen.

Secondary wastewater effluent (population equivalent 3000) was treated in an experimental watercourse near Oldenburg, Germany. The watercourse was 0.42 ha in area, 1800 m long and 2.4 m wide, planted with emergent macrophytes (Schoenoplectus lacustris L. Pallas., Typha latifolia L., and Glyceria maxima Hartm. Holmb.) with a total standing stock of 15,800 kg dry matter (3.76 kg per sq m). Secondary effluent was flooded (0.2-0.3 m deep, maximum flow 60 liters per sec) through the ditch during May-September 1977 and April-July 1978. Average night oxygen concentrations were 2 mg per liter in the inflow and 9 mg per liter in the outflow. Orthophosphate levels decreased from 0.063 to 0.011 nmol per liter and inorganic N levels from 0.603 to 0.257 nmol in the inflow and outflow, respectively. Inflow concentrations were reduced by 83% for orthophosphate and 57% for nitrogen. Total nutrient reductions for the growing season were 125 mol orthophosphate per day and 840 mol nitrogen per day, equivalent to 64% orthophosphate removal and 72% N removal. The watercourse was modified by removing half the macrophytes (standing stock 6600 kg(to enhance water flow for the periods August-October 1978 and May-October 1979. Oxygen concentrations were not increased during the second series of experiments. Phosphate removal was 47.5% and N removal was 15.1% in August-October, 1978, and no significant removal was observed in 1979. (Cassar-FRC)
W83-00843

METHODS OF ANALYZING QUINONES IN WATER AND THEIR APPLICATION IN STUDYING THE EFFECTS OF HYDROPHYTES ON PHENOLS. PART 5: ELIMINATION OF CARCINOGENIC AMINES FROM SOLUTIONS UNDER THE ACTION OF NITELLA,
Irkutshii Gosudarstvennyi Univ. (USSR). Scientific Research Inst. of Biology.
D. J. Stom, S. S. Timofeeva, N. F. Kashina, L. J. Bielykh, and S. N. Souslov.
Acta Hydrochimica et Hydrobiologica, Vol 8, No 3, p 241-245, 1980. 4 Fig, 1 Tab, 8 Ref.

Descriptors: *Amines, *Algae, *Absorption, Fate of pollutants, *Wastewater treatment, Benzidine, Naphthylamine, Aromatic compounds, *Nitella, *Carcinogens.

Removal of benzidine and alpha-naphtylamine by Nitella was studied in laboratory aquariums and in 1-8 cu m tanks on the shore of Lake Bikal. Concentrations of the added amines were 0.00001-0.001 M. At Nitella concentrations of 10 g per liter and an initial benzidine concentration of 0.000105 mol per liter, 68.7% of benzidine remained after 24 hours; alpha-naphthylamine (concentration unspecified) was reduced by 25% in 24 hours. In control solutions (no plants) only 5-7% of the original material was lost. Benzidine absorption increased 1.5-1.8 times with a doubling of the algal biomass. Lower concentrations of benzidine disappeared more rapidly than higher concentrations. Amines accumulated in Nitella protoplasm. A pilot plant test in experimental ponds showed reductions of 25-30% benzidine and alpha-naphthylamine at concentrations of 0.0001 M. (Cassar-FRC)
W83-00851

METHODS OF ANALYZING QUINONES IN WATER AND THEIR APPLICATION IN STUDYING THE EFFECTS OF HYDROPHYTES ON PHENOLS. PART 3: PHENOL ELIMINATION UNDER THE ACTION OF AQUATIC PLANTS,
Irkutskii Gosudarstvennyi Univ. (USSR). Scientific Research Inst. of Biology.
D. J. Stom, S. S. Timofeeva, N. F. Kashina, L. J. Bielykh, and S. N. Souslov.
Acta Hydrochimica et Hydrobiologica, Vol 8, No 3, p 223-230, 1980. 5 Fig, 2 Tab, 15 Ref.

Descriptors: *Quinones, *Degradation, *Aquatic plants, *Phenols, Wastewater treatment, Fate of pollutants, Phenol, Pyrocatechol, Hydroquinone, Guayacol, p-Cresol, Biodegradation, Algae, Pulp and paper industry, Kinetics.

Phenol decomposition by algae and aquatic plants proceeded by first-order kinetics in tests conducted in aquarium cultures and in experimental ponds. Plants (Nitella, Myriphyllum, Elodea, Oedogonium, Ceratophyllum, and Riccea) were obtained from several Russian lakes and rivers. River sand was the substrate. Plants at concentrations of 10 g per liter and at 2-4 g per liter were exposed to phenolic ccompound solutions in concentrations of 0.00001-0.001 M. Compounds were pyrocatechol, hydroquinone, phenol, guaiacol, and p-cresol. In the presence of 2 g per liter algae, phenols at 100 mg per liter disappeared completely within 15-20 days, and at 1-10 mg per liter, 2-5 times faster. In control tests with inactivated bacteria a, phenol reduction of 10-15% was seen in the 3-4 week period. Constants of the phenol conversion rates in plant communities exceeded those of autooxidation by 3-5 times. The purifying properties of aquatic plants were tested in 90 cu m experimental ponds with added phenolic compounds (1 mg per liter pyrocatechol and 5 mg per liter guaiacol). Pyrocatechol was completely destroyed in 5-6 days; guaiacol, in 8-10 days. (Cassar-FRC)
W83-00852

ROLE OF PHOSPHORUS IN ACTIVATED SLUDGE,
Pittsburgh Univ., PA. Dept. of Civil Engineering.
Y. C. Wu, and M. S. Okrutny.
Biotechnology and Bioengineering, Vol 24, No 8, p 1813-1826, August, 1982. 9 Fig, 3 Tab, 16 Ref.

Descriptors: *Activated sludge process, *Phosphorus, *Nutrient requirements, Limiting nutrients, Kinetics, Growth rate, Chemical oxygen demand, Cell yield, Sludge, Carbohydrates, Proteins, *Wastewater treatment, Microorganisms.

Phosphorus limitation in the activated sludge process was investigated at COD:P ratios of 10-1766.6:1 in batch and continuous-flow systems. In the batch system operating at 25C and increasing the COD:P ratio from 10:1 to 788:1, the specific growth rate decreased from 0.617 to 0.092, and the cell yield increased from 25.5 to 117.5. Maximum specific growth rate was 0.64 per hours, and saturation constant was 0.378 mg per liter. In the continuous-flow system biological solids production and COD removal were adversely affected by added P concentrations of less than 5.1 mg per liter or COD:P ratios above 105:1. At COD:P ratios lower than 105:1 no additonal COD removal was achieved. However, significant reductions in cell yield coefficient occurred at lower COD:P ratios. At lower P levels sludge from the continuous-flow process contained greater proporations of carbohydrates and smaller proportions of protein. The sludge microorganisms under severely limited P conditions had exceptionally large capsules. The kinetic constants obtained from the batch studies were used to predict cell yield in continuous-flow systems. (Cassar-FRC)
W83-00861

COOXIDATION OF BENZO(A)PYRENE AND PHENOLS ON ACTIVATED SLUDGES,
Akademiya Nauk Estonskoi SSR, Tallinn. Tallinskii Politekhnicheskii Inst.
U. Kurso, and M. Hannus.
Acta Hydrochimica et Hydrobiologica, Vol 8, No 2, p 131-136, 1980. 3 Fig, 1 Tab, 14 Ref.

Descriptors: *Activated sludge process, *Polynuclear aromatic compounds, *Oxidation, Fate of pollutants, *Wastewater treatment, Organic compounds, Benzopyrene, Aromatic compounds, Phenols, Degradation, Biological treatment.

A synthetic wastewater containing 4 times 10 to the minus 7th power mole per liter benzo(a)pyrene (BAP) and 5 times 10 to the minus 5th power mole per liter of a mixture of oil shale alkylresorcinols was treated in laboratory activated sludge systems. BAP removal was 81% in the aerated tank and

72% in trickling filters. BAP inhibited the oxidation of phenol and the alkylresorcinol mixture by 30%. Since the activated sludge microorganisms reatained their activity, it was possible to reuse the same biomass without regeneration. Degradation products of BAP included 1,6- and 3,6-quinones of BAP and chrysene and naphythalene derivatives. (Cassar-FRC)
W83-00866

COMBINED TREATMENT PLANT HANDLES CITY AND PAPERBOARD MILL EFFLUENT,
Nabisco Wastewater Treatment Center, Marseilles, IL.
A. Burton, and W. H. Jollie.
Pulp and Paper, Vol 56, No 7, p 61-63, July, 1982. 5 Fig.

Descriptors: *Wastewater treatment, *Pulp and paper industry, *Industrial wastes, Illinois River, *Municipal wastes, Sludge processes, Activated sludge process, Primary wastewater treatment, Secondary wastewater treatment, Anaerobic conditions, Digestion, Design criteria, *Illinois.

The system used to handle both mill effluent and municipal waste for the city of Marseilles, Illinois is described. The city's original primary treatment plant, remodeled in 1964, consisted of a bar screen, grit chamber, dual primary settling basins, anaerobic digester, and sludge drying beds. Maximum flow is 160% of maximum design flow, indicating that a very large amount of surface water is entering the sewage collection system. The wastewater treatment system for the pulp and paper mill is basically a solids removal system. The various waste streams are collected in a common interceptor and pumped to sidehill screens to remove large solids such as plastics and unrefined fibers. A 0.83 million gallon primary clarifier that removes in excess of 96% of the suspended solids and reduces biological oxygen demand by about 48% is part of the system. Flow then enters a filtration plant. Just prior to entering the second sedimentation tank an anionic polymer is added to increase alum floc size and improve settling properties. A secondary activated sludge system consists of three aeration tanks, two finals clarifiers, two aerobic digesters, and ten sludge drying beds. Two operating problems have occurred. One deals with the increasing filamentous bacteria concentration and the second concerns overloading aerobic digesers. (Baker-FRC)
W83-00893

ACTIVATED SLUDGE,
Maryland Univ., College Park. Dept. of Civil Engineering.
J. E. Alleman, D. A. Smith, and J. H. Sherrard.
Journal of the Water Pollution Control Federation (Literature Review Issue), Vol 54, No 6, p 599-610, June, 1982. 176 Ref.

Descriptors: *Wastewater treatment, *Literature review, *Activated sludge process, *Biological wastewater treatment, Model studies, Research priorities, Performance evaluation, Automation, Process control, Industrial wastewater, Activated sludge, Sludge, Nitrification, Denitrification, Oxygen uptake, Oxygen transfer.

A review of 176 publications on the use of activated sludge as a method of wastewater treatment is presented. Works on process modeling included presentations of models for biomass, aerobic bacterial metabolism, particulate uptake, metabolism, and mineralization, influent and effluent COD, and effluent quality. Process research publications focused on solids retention time, sludge and biomass viability, the effects of influent phosphorus concentration, and a gas chromatographic procedure for poly-hydroxybutyrate determination. Design and performance studies covered the start-up and operation of full-scale activated sludge facilities, the performance of pure-oxygen and extended aeration package plants, foam control alternatives, and viruses in secondary effluent. Instrumentation and automation was treated by works on the application of various sensors and analyzers, full-scale application of computer control for energy conservation and cost effectiveness, and microprocessor automation. Publications on process control discussed modeling procedures, fluidic and aeration control, dissolved oxygen control, relationships between control parameters and the microbial community, and solids control. Fifty-one publications concerning industrial wastewaters are reviewed; the emphasis was on high-organics wastes, palm-oil processing effluents, the biodegradability of phenol and methanol, coal- and coke- industry effluents, wood, pulp and papermill wastes, the effects of chemical compounds on the activated-sludge process, the fate of heavy metals in the process and the effect of type A zeolite upon them, the powdered activated carbon process, and microbial response to organic compounds. Nitrogen metabolism was covered by works on nitrification, denitrification, and the combined nitrification/dentrification process. Five publication on sludge characteristics are reviewed, while oxygen uptake and transfer was treated by nine works focusing on procedures to estimate transfer rates and critical floc size, results of field tests to determine transfer rates in aeration tanks, and the validity of oxygen uptake rate as a control parameter. (Gish-FRC)
W83-00943

TRANSFORMATION OF BENZO(A)PYRENE IN A MIXTURE WITH PHENOLS UNDER THE EFFECT OF ALGAE AND THEIR ENZYME PREPARATIONS,
Irkutskii Gosudarstvennyi Univ. (USSR). Scientific Research Inst. of Biology.
For primary bibliographic entry see Field 5B.
W83-00961

EXAMINATION AND EVALUATION OF BIOLOGICAL DEGRADING OF METAL GLUCONATE COMPLEXES THROUGH THE ZAHN/WALLENS BATCH METHOD (PRUFUNG UND BEWERTUNG DER BIOLOGISCHEN ABBAUBARKEIT VON ME GLUCONATKOMPLEXEN IM STANDVERSUCH NACH ZAHN/WELLENS),
Benckiser (Joh. A.) G.m.b.H., Ludwigshafen am Rhein (Germany, F.R.).
G. Marguereanu.
Zeitschrift fur Wasser und Abwasser Forschung, Vol 14, No 1, p 10-13, February, 1981. 3 Fig, 4 Tab, 14 Ref.

Descriptors: *Biodegradation, *Metal-gluconate complexes, *Sludge, *Ions, Iron, Aluminum, Copper, Zinc, Chromium, Gluconate, Metal complexes, Heavy metals, Water quality, Water pollution, sludge digestion, sodium, Diethylene glycol, Path of pollutants, Wastewater treatment.

The Zahn/Wellens batch method was used to determine whether metal-gluconate complexes (particularly bi- and trivalent metal complexes) were as easily biodegradable in water as Na-gluconate. Two concentrations were tested in non-adapted sludge: 0.08 and 0.1% gluconate (800 and 1,000 mg/l COD, respectively), and biodegradation was measured by determining the COD levels in the filtrate daily or at other time intervals. Cu-gluconate was degraded 96.2% for both concentrations after 5 days, whereas the standard Na-gluconate was degraded by 98.9% after 3 days. Al(3+)- and Cu(2+)-gluconate were degraded by over 96% by day 3 of the experiment, which was ended after 5 days; the final metal concentrations in the remaining fluids were 43 mg/l for Al(3+) and 19 mg/l for Cu(2+), with original concentrations of 105 and 378 mg/l, respectively. Fe(3+)- and Zn(2+)-gluconate were compared with diethylene glycol (DEG) as standard. DEG had degraded by 93.4% after 8 days and 96.2% after 17 days, whereas Fe(3+)-gluconate was degraded 92.0% after 5 days and 93.6% after 6 days for concentrations of 1,000 and 800 mg/l, respectively, compared with 96.1% after 7 days and 96.0% after 5 days for Zn(2+)-gluconate. The final concentrations of Fe(3+) and Zn(2+) in the fluid left at the end of the experiment were 55 mg/l and 242 mg/l, respectively. Cr(3+)-gluconate was tested in three concentrations: 243 mg/l (corresponding to Cr(3+): gluconate = 1:1, as was the ratio for the other metals), 120 mg/l and 180 mg/l. After 19 days, the percentages of degradation were 84.5, 89.8 and 97.1 for these concentrations, respectively whereas DEG was 94.7% degraded after 15 days. although the degradation was more rapid with lower concentrations the differences in concentration did not affect the final result. The final concentration of Cr(3+) was 210 mg/l for the highest original concentration. The experiment showed that metal-gluconate complexes, with the exception of Cr(3+)-gluconate, are easily biodegradable in non-adapted sludge. (Gish-FRC)
W83-00972

STANDARIZATION OF EQUIPMENT AND FACILITIES-AN IMPORTANT PREREQUISITE FOR EFFECTIVE PRODUCTION OF WATER-RELATED EQUIPMENT IN COMECON MEMBER COUNTRIES (TYPISIERUNG VON AUSRUSTUGEN UND ANLAGEN - WICHTIGE VORAUSSETZUNG FUR EINE EFFEKTIVE PRODUCTION WASSERWIRTSCHAFTLICHER AUSRUSTUNGEN IN DEN RGW-MITGLIEDSLANDERN,
VEB Kombinat Wassertechnik, Berlin (German, D.R.).
For primary bibliographic entry see Field 5F.
W83-00978

BIOLOGICAL WASTE AND DRINKING WATER TREATMENT: THE ADVANTAGES OF BACTERIAL FIXATION ON A SUPPORT,
For primary bibliographic entry see Field 5F.
W83-01018

WATER DECONTAMINATION PROCESS IMPROVEMENT TESTS AND CONSIDERATIONS,
Oak Ridge National Lab., TN.
E. D. Collins, D. O. Campbell, L. J. King, and J. B. Knauer.
AIChE Symposium Series, Vol 78, No 213, p 9-15, 1982. 8 Fig, 3 Tab, 4 Ref.

Descriptors: *Radioactive wastes, *Ion exchange, *Nuclear powerplants, *Wastewater treatment, Cesium, Strontium, Ruthenium, Antimony, Zeolite, Three Mile Island, Powerplants.

The Submerged Demineralizer System (SDS), designed for decontaminating the high-activity-level water at Three Mile Island-2, was improved after a series of tests. The amount of Cs and Sr loaded onto the zeolite adsorbent was increased by a factor of 5 by changing the organic cationic resin in the last of 4 columns to zeolite and by using mixed zeolites (Linde A-51 and Linde IE-95, sodium form) in place of 100% IE-95. Cs and Sr concentrations in the zeolite effluent water were reduced by an aging period of several hours at 75 C before final contact with zeolite. This was based on the theory that residual species adsorbed onto colloids would reequilibrate with the water and become more susceptible to removal by subsequent ion exchange treatment. The anionic contaminants, Sb125 and Ru106, were removed by deionizing the water by removal of sodium ions with a hydrogen-form cation exchange resin, followed by sorption of the contaminants on an anion resin, Nalcite SBR, in the borate form. (Cassar-FRC)
W83-01037

5E. Ultimate Disposal Of Wastes

STABILIZATION OF WASTE-ACTIVATED SLUDGE THROUGH THE ANOXIC-AEROBIC DIGESTION PROCESS,
Osaka Univ. (Japan). Dept. of Environmental Engineering.
S. Hashimoto, M. Fujita, and K. Terai.
Biotechnology and Bioengineering, Vol 24, No 8, p 1789-1802. August, 1982. 5 Fig, 3 Tab, 8 Ref.

Descriptors: *Digestion, *Anaerobic digestion, *Nitrogen removal, *Sludge digestion, Aerobic digestion, Activated sludge, Biological treatment, Volatile suspended solids, Suspended solids, Nitrification, Denitrification.

The anoxic-aerobic digestion process was used to reduce volatile suspended solids (VSS) concentra-

tions and total nitrogen content of waste activated sludge. Two methods were evaluated: continuous and semicontinuous. In the continuous process the sludge was fed at a constant flow rate, and digested sludge was withdrawn once a day. In the semicontinuous process digested sludge was withdrawn from the aerobic tank every 2-5 days. The remaining digested sludge in the anoxic and aerobic tanks were mixed together. This mixture was replaced in the aerobic tank, and mixed sludge plus new activated sludge was placed in the anoxic tank. In the continuous process VSS reductions were 32-48%, total N removals were 13-27%, nitrification efficiencies were 41-54%, and denitrification efficiencies were 31-59%. In the semicontinuous process VSS reductions were 37-46%, total N removals were 31-41%, nitrification efficiencies were 44-55%, and denitrification efficiencies were 64-74%. The aerobic process, used as a control, achieved 33-36% VSS removal and 2-5% total N removal. Maximum percent reduction of VSS and total N was achieved at a Qr/Qs ratio (sludge circulation flow rate/influent flow rate) of 2. This treatment system is also applicable to primary sludge, industrial sludge, and animal manure. (Cassar-FRC)
W83-00713

OCEAN DUMPING OF SEWAGE SLUDGE: THE TIDE TURNS FROM PROTECTION TO MANAGEMENT,
Harvard Law School, Cambridge, MA.
For primary bibliographic entry see Field 6E.
W83-00732

REMOVAL OF NITROGEN AND PHOSPHORUS FROM UNTREATED MILKING-SHED WASTES AFTER APPLICATION TO PERMANENT PASTURE,
Massey Univ., Palmerston North (New Zealand).
A. N. Macgregor, D. G. Bowler, T. O. Tan, and J. K. Syers.
Agricultural Water Management, Vol 5, No 2, p 181-191, May, 1982. 2 Fig, 7 Tab, 14 Ref.

Descriptors: *Waste disposal *Sprinkler irrigation, Irrigation, Sprinklers, Sprinkling, Agricultural watershed, Nitrogen, Phosphorus, Infiltration, Percolation, Drainage, Dairy industry, Animal wastes, Farms.

The amounts of nitrogen and phosphorus entering and leaving an intensively drained pasture disposal site over a 3-year period were investigated. Data are presented which assist in the evaluation of permanent pasture as a storage medium for nitrogen and phosphorus following field application of untreated dairyshed wastewater by sprinkler irrigation. The disposal site was unimproved permanent pasture located adjacent to the milking shed of a dairy farm. The site comprised 1.6 ha of level pasture with a mixed sward of ryegrass and white clover, with lesser amounts of brown top and poa. The pasture had been in this condition for the proceding 10 years. The pasture disposal site received between 960-1280 kg nitrogen/ha/year and 130-180 kg phosphorus/ha/year. About 90% of the P applied could be accounted for in the top 5 cm of the pasture soil. In contrast, only 15% of the N applied could be accounted for, and there was no evidence that the pasture soil was able to serve as a storage medium for nitrogen. It is considered unlikely that large amounts of nitrogen were lost from the soil-plant system by gaseous mechanisms such as denitrification. (Baker-FRC)
W83-00819

OPEN OCEAN DISPOSAL OF MATERIALS DREDGED FROM A HIGHLY INDUSTRIALIZED ESTUARY: AN EVALUATION OF POTENTIAL LETHAL EFFECTS,
Old Dominion Univ., Norfolk, VA. Dept. of Biological Sciences.
R. W. Alden, III, and R. J. Young, Jr.
Archives of Environmental Contamination and Toxicology, Vol 11, No 5, p 567-576, 1982. 4 Fig, 2 Tab, 16 Ref.

Descriptors: *Disposal, *Industrial wastes, *Ocean dumping, Waste disposal, Estuaries, Water pollution effects, Dredging, Estuarine environment, Sediments, Suspended sediments, Chesapeake Bay, Hampton Roads, Elizabeth River, *Virginia.

An assessment was made of the potential biological impact of open ocean disposal of sediments from dredging sites in the Chesapeake Bay, Hampton Roads Harbor and the Elizabeth River, Virginia. Sediments from selected sites in this seaport system were evaluated through a series of bioassays designed to test the acute toxicity of various sediment fractions. Dissolved materials which would be released during disposal operations did not produce significant lethal effects for the grass shrimp Palaemonetes pugio at any of the test sites. The fine suspended material associated with sediment disposal was not significantly toxic for most of the stations tested. However, rapid lethal effects were noted during the suspended solid phase experiments for a few of the most highly industrialized sites. Exposure of the shrimp to deposited sediment produced moderately low mortalities throughout a ten day experiment. The findings indicate that, in the experiments where significant lethal effects were noted, the toxicity was mainly associated with suspended solids. This trend has significant environmental implications for open ocean disposal operations, as most of the fine materials would probably be dissipated quite rapidly in the dynamic environment of an offshore disposal site. (Baker-FRC)
W83-01030

5F. Water Treatment and Quality Alteration

EXPERIENCE WITH THE EEC DIRECTIVE 75/440 ON THE QUALITY OF SURFACE WATER FOR DRINKING WATER PROCUREMENT IN THE MEMBER STATES (ERFAHRUNGEN MIT DER EG-RICHTLINIE 75/440 UBER DIE QUALITAT VON OBERFLACHENWASSER FUR DIE TRINK-WASSERGEWINNUNG IN DEN MITGLIEDSSTAATEN),
EUREAU - UNION of Water-Supplying Associations of Member Countries of the European Communities.
For primary bibliographic entry see Field 6F.
W83-00771

THE OCCURRENCE OF FILAMENTOUS FUNGI IN DRINKING WATER DISTRIBUTION SYSTEMS,
California Univ., Irvine. Div. of Environmental Analysis.
L. A. Nagy, and B. H. Olson.
Canadian Journal of Microbiology, Vol 28, No 6, p 667-671, June, 1982. 2 Fig, 2 Tab, 15 Ref.

Descriptors: *Drinking water, *Chlorination, *Fungi, *Bacteria, Water treatment, Water distribution, Water conveyance, Deuteromycotina, Penicillium, Sporocybe, Acremonium, Paecilomyces, Hydrogen ion concentration, Turbidity, *California.

An enumeration was made of filamentous fungi in drinking water using the membrane filtration procedure. Two water systems located in Orange County, California were investigated. One system used fully treated chlorinated surface water, while the other system used unchlorinated groundwater. Assessments were made at 8 separate times over a 1 year period. Filamentous fungi were found in drinking water distribution systems in detectable quantities, and membrane filtration was successful in estimating their numbers. On the average, 15-40 filamentous fungal CFUs were present in 100 ml of drinking water throughout the year. The concentration of fungi observed in both the chlorinated and unchlorinated systems was generally two to three orders of magnitude below the concentration of bacteria. The majority of the fungal genera appeared to be nonpathogenic, saprophytic Deuteromycotina, which generally obtained their nutrition from decaying plant material. Although a number of physicochemical and bacteriological parameters were assessed, only turbidity and pH indicated a significant correlation with fungal frequencies, and even this was only observed in the chlorinated system. The cause of a simultaneous increase in the values of these three variables was not sought. Of the bacteriological parameters tested, none showed a statistically significant correlation with observed fungal values in either the chlorinated or the unchlorinated system. The unchlorinated system, with its relatively high levels of bacteria, had fewer fungi than the chlorinated system, which chracteristically contained fewer bacteria. (Baker-FRC)
W83-00849

FULL MARKS FOR OXFAM'S WATER SUPPLY PACKAGE.
World Water, Vol 5, No 7, p 19, July, 1982. 2 Fig.

Descriptors: *Water supply, *Mechanical equipment, *Drinking water, Water treatment, Water conveyance, Package systems, Water distribution, Planning, Management, Disaster, Water resources development, Water demand.

The idea of packaged modular water systems which can be transported quickly to places in need has been the subject of a two-year study. The criteria were that 5 gal per person per day should be available, that a unit population of 5,000 should be served with multiplication of items for larger numbers, that equipment should be interchangeable for different uses in different locations, and that all items should be chosen for reliability, robustness, simplicity of installation, light weight, availability and low cost. The first two packages, for water storage and distribution, are already worked out and scheduled for assembly and trials. Future packages will cover surface water treatment, river intake, dug wells, tube wells and pumping. Various packages will be combined to provide a suitable system. For example, a surface source might require an intake package, a pumping package, a treatment package, a storage package and a distribution package. The storage module consists of three 7-m-diameter 1.2m high circular tanks each with a capacity of 44 cubic meters and constructed with seven 3 m long galvanized corrugated steel sheets. With the tanks go link pipework, tools, a chlorination kit and a roofing kit if needed. The distribution module contains four kits: pumping, supply, water collection point, and venting and draining. The next package scheduled for completion is the surface water treatment module. (Baker-FRC)
W83-00968

STANDARIZATION OF EQUIPMENT AND FACILITIES-AN IMPORTANT PREREQUISITE FOR EFFECTIVE PRODUCTION OF WATER-RELATED EQUIPMENT IN COMECON MEMBER COUNTRIES (TYPISIERUNG VON AUSRUSTUGEN UND ANLAGEN - WICHTIGE VORAUSSETZUNG FUR EINE EFFEKTIVE PRODUCTION WASSERWIRTSCHAFTLICHER AUSRUSTUNGEN IN DEN RGW-MITGLIEDSLANDERN,
VEB Kombinat Wassertechnik, Berlin (German, D.R.).
G. Heilemann.
Wasserwirtschaft-Wassertechnik, Vol 31, No 9, p 297-298, 1981. 3 Tab. (No English Summary).

Descriptors: *Design standards, *Water treatment facilities, *COMECON, *Apparatus, Standards, Wastewater treatment, Sewers, Mechanical equipment, Technology.

The expansion of international specialization and cooperation in science, technology, and production within COMECON was one of the goals of the tenth congress of the Socialist Unity Party of the German Democratic Republic. In terms of water this meant principally the standardization of equipment, construction, and control and monitoring devices. A nomenclature system was developed for water treatment plants, in which currently manufactured equipment was divided into four groups: that belonging directly to water-treatment technology; that serving for preparation or dosing of reagents for water or residue treatment; that generally required for residue treatment; and pumps specially developed for wastewater and sludge with gross ipurities. For equipment that is expected to be produced in the future, a nomenclature

system of nine groups was developed: equipment for sieving, aeration, sedimentation and flocculation, filtration, full-scale water treatment facilities, disinfection and further water-quality improvement treatment of residues, transport of wastewater and sludge with gross impurities, and for the preparation, dosing, and regeneration of reagents. An example of the usefulness of such standardization is the sewer grid with mechanical cleaning that is now used in all COMECON countries in three forms: arch grid (manufactured in Bulgaria, Hungary, Poland): disgonal grid (Bulgaria, Poland, USSR, Czechoslovakia); and vertical grid (GDR, USSR). The geometric parameters sewer width and depth and maximal water level in the sewer are the main means of standardization. If these and standard bar intervals and discharge heights are adhered to, grids from all manufacturers will be interchangeable. Further results of international cooperation were catalogues of equipment and expanded suggestions for standardization. (Gish-FRC)
W83-00978

THE NEW 'PRINSES JULIANA' WATER EXTRACTION PLANT OF THE RHINE-KENNEMERLAND WATER TRANSPORT COMPANY,
J. J. Haasnoot.
Aqua, No 5, p 41-42, 44, 1982. 2 Fig.

Descriptors: *Water supply, *Water resources development, *Aeration, *Water transport, Construction, IJsselmeer, Reservoirs, Purification, Drinking water, Water treatment, Filtration, Flocculation, Settling, Straining, Algae, *The Netherlands.

In 1981 a new water extraction plant was opened at Enkhuizen on the IJsselmeer. This plant has a capacity of 110 million cubic meters per year and a maximum delivery flow rate of 15,000 cubic meters per hour. The project cost about 410 million Guilders. Water is not taken directly from the IJsselmeer, but first passes through a reservoir with an area of 85 ha and maximum depth of 20 m. Air injection in the middle of the reservoir bottom helps to commix the shallow and deep water layers so that the algae are mostly in the dark and their growth rate retarded. The plant site covers 25 ha of reclaimed land. The IJsselmeer water passes through the following steps: settling and algae control in the intake reservoir, fish screening, intake gratings, strainers, addition of chemicals, flocculation, settling, and filtration. The water extraction plant is extensively automated and provided with a very modern central control system whereby the whole plant can be operated by a single worker. (Baker-FRC)
W83-01013

UNIFIED MANAGEMENT OF WATER SUPPLY IN TAIWAN.
China Water Works Association (Taiwan).
Aqua, No 5, p 34-35, 1982. 1 Tab.

Descriptors: *Water demand, *Water management, *Drinking water, *Water resources development, *Taiwan, Taiwan Water Supply Corporation, Management, Planning.

Before unification of the water supply in Taiwan was accomplished there were 128 water works which were owned and managed separately by provincial and local governments. Since the Taiwan Water Supply Corporation was established in January of 1974 many steps were undertaken to improve the situation. First, $31.7 million US was invested to develop new water resources to prevent a recurrence of black-foot disease among coastal area residents who, prior to that time, had been drinking water containing arsenic. Drinking water installations have been improved in 973 remote villages. The TWSC was able to provide much needed water to all areas of Taiwan hit by an unusual drought period during 1976-77. In the summer of 1977 some of the water supply systems were seriously damaged by typhoons, and TWSC mobilized a large number of workers and large amounts of machinery and materials to repair the damaged supply in very short periods of time. (Baker-FRC)
W83-01015

THE WATER SUPPLY IN SWITZERLAND, A SURVEY OF THE STRUCTURE,
Eidgenoessisches Amt fuer Umweltschutz, Bern (Switzerland).
P. Michel, J. Schmid, and E. Trueb.
Aqua, No 5, p 10-11, 13, 1982. 3 Fig, 5 Ref.

Descriptors: *Water supply, *Administration, *Drinking water, *Water resources management, Legal aspects, *Switzerland.

The water supply in Switzerland is primarily the responsibility of the municipalities. A new Water Management Article, approved by the Swiss population and the Cantons on December 7, 1975, reaffirms that the right of disposition of the water resources rests with the Cantons. Even so, the Confederation is empowered, within an omnibus law, to promulgate principles for the preservation and development of water resources, especially for drinking water supply and the enrichment of groundwater. With very few exceptions, the water suppliers in Switzerland are owner-operator enterprises of the municipalities or of corporations under the Cantonal Public Law. City supplies are very often a combination of lakewater treatment and groundwater production. Treatment technology is highly advanced and generally consists of flocculation, filtration with pH regulation, multilayer filtration, ozone oxidation are subsequent pressure filtration, GAC-filtration and a safety disinfection. (Baker-FRC)
W83-01016

THE WATER SUPPLY OF AN AGGLOMERATION AREA IN SWITZERLAND,
H. C. M. Schalekamp.
Aqua, No 5, p 18-21, 23, 25, 1982. 21 Fig.

Descriptors: *Water resources development, *Water supply, *Municipal water, Zurich, *Switzerland, Water demand, Drinking water, Potable water.

The primary sources of drinking water in Switzerland include spring water and groundwater. However, each area of the country is also dependent upon surface water to some extent. This paper reviews the methods used at present to obtain a sufficient amount of water at adequate pressure and of first-class quality at a favorable price for the agglomeration area of Zurich. In 1969 the municipal water supply depended on four main production facilities. The decisive factors for dimensioning Swiss water supply facilities have up to now been the demographic evolution and the specific water consumption per inhabitant per day. Extension of the Zurich water supply during the past 10 years has been accomplished through an extension of the Lengg Lakewater Plant by constructing a remote action facility and extending the transport lines, construction of the Hardhof Groundwater Plant, new construction of distribution facilities, new construction of works yard and office building, modernization of the existing Moos Lakewater Plant, and installation of an emergency water supply along with implementation of green spaces and sports grounds which serve as protection for the groundwater carrier. (Baker-FRC)
W83-01017

BIOLOGICAL WASTE AND DRINKING WATER TREATMENT: THE ADVANTAGES OF BACTERIAL FIXATION ON A SUPPORT,
J. M. Philipot.
Aqua, No 5, p 28-30, 1982. 1 Fig, 1 Tab.

Descriptors: *Biological treatment, *Bacteria, *Water treatment, *Wastewater treatment, Drinking water, Urban wastewater, Purification, Chlorination, Biocarbone process.

In drinking water treatment, it is now possible to design mixed lines including one or more biological stages, which allows improvement in the quality of treated water while limiting the amount of reagents used, especially chlorine. For urban or industrial wastewater, aerated biological filtration of the Biocarbone type results in structures of reduced volume and better purification efficiency. Stricter standards on discharges can also be met. Bacterial fixation on a support maintains a very high level of activated biomass concentration in the reactor. With fixed bacteria, drinking water can be produced from surface water by biological means. The choice of support material depends on the component to be removed, its contents, and the treatment's location within the plant's line. The fixation of microorganisms on a support increases cellular metabolism. The application of the fixation of a biomass on a support, the system, is discussed for two examples, Annet-sur-Marne and Soissons. (Baker-FRC)
W83-01018

SELECTION OF ANTIBIOTIC-RESISTANT STANDARD PLATE COUNT BACTERIA DURING WATER TREATMENT,
Oregon State Univ., Corvallis. Dept. of Microbiology.
J. L. Armstrong, J. J. Calomiris, and R. J. Seidler.
Applied and Environmental Microbiology, Vol 44, No 2, p 308-316, August, 1982. 5 Fig, 3 Tab, 20 Ref.

Descriptors: *Bacteria, *Antibiotics, *Resistance, Drinking water, *Water treatment, Chlorination, Drugs, Adaptation, Fate of pollutants.

Examination of standard plate count bacteria in a water treatment facility revealed a larger proportion of antibiotic-resistant bacteria in treated drinking water than in the raw surface water source in Oregon. Of the bacterial isolates found in raw river water, 19-44% were antibiotic-resistant; in the flash mixer, 46-70%; and in the clear well, 36-79%. More bacteria were resistant to sulfanilamide than to carbenicillin, chloramphenicol, kanamycin, streptomycin, or tetracycline. The percentage of bacteria resistant to 2 to 5 antibiotics were 15.8% in river water, 17.5% in flash mix water, and 57.1% in clear well water. Chlorination increased the proportion of drug-resistant bacteria. (Cassar-FRC)
W83-01020

OPERATIONS MONITORING SYSTEM AT THE HELSINKI CITY WATERWORKS,
Helsinki City Waterworks (Finland).
V. Lappalainen.
Aqua, No 5, p 0485-0488, 1982. 7 Fig.

Descriptors: *Monitoring, *Automation, Planning, Mathematical models, *Water treatment facilities, Flocculation, Clarification, Computers, Helsinki, Management, *Operations, Filtration, Ozonation, Chlorination, *Finland.

A reorganization and centralization of the operations monitoring system is underway at the Helsinki City Waterworks. In connection with the waterworks head office a central control room has been set up to carry out the centralized operations monitoring and control of the whole waterworks process. The system, new in its technology, is a modern process monitoring system using computers and mathematical methods. The article presents the development goals of the system, describes the principal parts of the waterworks process, the systems' monitoring hierarchy and monitoring points, equipment and computer systems, and gives an estimate on the results achieved with the new system. Direct savings in total operating costs can be achieved by using operations control based on an optimization model. Operating costs comprise energy, chemical and sludge handling costs, which were approximately 10 million Finnmarks in 1981. Systematic and effective monitoring has revealed ineffective or uneconomical parts of the process, and the necessary corrective measures have been taken. Improved and more rapid data registration and availability as well as processing diversification are also important. (Baker-FRC)
W83-01032

THE USE OF BIO-TECHNICS IN WATER TREATMENT: FEASIBILITY AND PERFORMANCE OF BIOLOGICAL TREATMENT OF NITRATES, (IN FRENCH),
A. Leprince, and Y. Richard.
Aqua, No 5, p 0455-0462, 1982. 6 Fig, 5 Tab, 34 Ref. English summary.

Descriptors: *Biological treatment, *Nitrates, *Denitrification, Water treatment, Groundwater, Drinking water, Water supplies, Industrial wastes, Water pollution sources, Agricultural chemicals, *France.

An increase in the nitrate content of underground waters in France has been noted over the past few years. This increase is attributed to nitrogen-based fertilizers which have not been absorbed by the crop and to domestic or industrial waste. This leads to a steady but irreversible increase in the nitrate content of the underground waters. Since the nitrate migration towards the underground water levels is fairly slow the nitrate problem is likely to become even more acute in the future. A denitrification process is presented in three steps - biological reaction, aeration, and filtration, which is being tested at a pilot plant. A detailed analysis of each of the three steps is offered, including the initial starting operation and possible stoppages. The industrial feasibility of the project is considered, along with the monitoring and measurement aspects of the process. Nitrates can be easily changed into nitrogen gas without any undesirable intermediate compounds being discernible in the treated water. This process totally eliminates the pollution, as no waste or concentrates that would be hard to remove are formed. The feasibility has been proved satisfactory, and it is now possible to consider the construction of industrial stations for the treatment of nitrates. (Baker-FRC)
W83-01034

5G. Water Quality Control

THE EFFECTS OF NUTRIENT, PH AND HERBICIDE LEVELS ON ALGAL GROWTH,
Langston Univ., OK.
For primary bibliographic entry see Field 5C.
W83-00707

AGGREGATES OF PARTICULATE MATTER AND AUFWUCHS ON ELODEA CANADENSIS IN IRRIGATION WATERS, AND INACTIVATION OF DIQUAT,
Commonwealth Scientific and Industrial Research Organization, Griffith (Australia). Irrigation Research Lab.
For primary bibliographic entry see Field 4A.
W83-00741

LIMNOLOGY OF HEART LAKE, ONTARIO,
Toronto University, Scarborough Coll., Toronto (Ontario).
For primary bibliographic entry see Field 2H.
W83-00774

THE DEVELOPMENT OF THE SALT PROBLEM IN THE RHINE IN THE 60'S AND 70'S (DIE ENTWICKLUNG DES SALZ-PROBLEMS AM RHEIN IN DEN 60ER UND 70ER JAHREN).
International Arbeitsgemeinschaft der Wasserwerke, Rheineinzugsgebiet (Germany, F.R.).
Gas-Wasserfach Wasser-Abwasser, Vol 123, No 5, p 263-264, May 1982. 1 Fig, 1 Tab, (No English summary).

Descriptors: *Chlorides, *Rhine river, *Water pollution treatment, *Water pollution prevention, *Legal aspects, Water quality, Salts, Federal Republic of Germany, Rivers, International commissions, International waters, France, Potash, Waste disposal, Underground waste disposal, Waste dumps.

Efforts to reduce the salt content of the Rhine river have been underway since 1960. In 1960 it was discovered that the main sources of chloride in the river were potash pits (discharging 85 kg chloride/sec), soda industry (55 kg/sec), Rhur-district coal mines (45 kg/sec), and other industries, domestic discharges, and natural salt (80kg/sec). At present the potash pits are discharging 130 kg chloride/sec, about 40% of the artificial chloride content of the Rhine. At various meetings of the ministers of the five states bordering the banks of the Rhine during the 1960s and early 1970s, it was decided that the only economical way of reducing salt discharge from the potash mines in Alsace was to dump the dry residual salt. Landfilling of 60 kg/sec was scheduled to begin in 1975. It became apparent that the cost of this would be higher than estimated, so the French delegation proposed the cheaper compression of salt into the Alsatian subsoil. The international ministers agreed to a first step of injecting 20 kg/sec chloride to begin in 1978. This has not yet been done. According to the French delegation the next step of a further 20 kg/sec reduction cannot be begun until the first phase is complete. With investigating the feasibility of injection in the Alsace region (costing 20 million French Francs/yr), ship tranportation of salt to the North Sea (92-107 million Francs/yr) and delivery of brine to soda factories in Lothringen (63 million Francs/yr). In November 1981 the 7th International Ministers' Conference charged France with the main responsibility for salt reduction in the river. The first stage of removal will be of 20 kg/sec, of which 6 kg/sec will be injected into salt mines and 14 kg/sec compressed into the Alsatian subsoil. The impression still exists that France is in no hurry to carry this out. (Gish-FRC)
W83-00785

GOALS, METHODS AND POSSIBILITIES FOR DIRECTING DEVELOPMENT OF LIMNIC ECOSYSTEMS,
Lund Univ. (Sweden). Limnological Inst.
S. Bjork.
Hydrobiologia, Vol 86, No 1/2, p 177-183, January, 1982. 4 Fig, 18 Ref.

Descriptors: *Limnology, *Lakes, *Wetlands, Ecosystems, Sediment control, Trophic level, Water management, Sweden, Lake Sediments, Lake restoration.

Case studies are described which illustrate lake and wetland ecosystem problems as well as restoration methods. Among these methods, aeration of deep lakes, sediment removal from shallow, polluted lakes, sediment manipulation in polluted and acidified lakes, biomanipulation and wetland management methods are considered. A treatment program for directing ecosystem development is designed in each individual case according to lake type, degradation problems and goals of restoration. The most common goal in treatment of lakes is to meiotrophicate (oligotrophicate) hypertrophicated ecosystems. In the case of wetlands, conservation and restoration aspects are combined with a growing interest focused on biomass production by emergent machrophytes. Within the practical framework of applied limnology, basic limnological research and training of graduate students have been organized as team-work for ecosystem-oriented investigations. In the El Penol (Columbia) reservoir, hypolimnetic aeration was recommended in order to precipitate dissolved iron and prevent it from fouling the hydroelectric system. The heavily polluted Lake Trummen (Sweden) was meiotrophicated by suction dredging the top sediment layer. Lake Lillesjon was treated by in situ calcium nitrate treatment with ferric chloride and slaked lime addition. In situ treatments are also being tested for pH regulation and water level lowering. (Baker-FRC)
W83-00790

ECE SEMINAR ON WATER UTILIZATION RECOMMENDS GIVING WATER MANAGEMENT POLICIES HIGH PRIORITY.
For primary bibliographic entry see Field 6D.
W83-00796

ECE WATER COMMITTEE RECOMMENDS DECLARATION ON WATER POLLUTION.
International Journal of Environmental Studies, Vol 15, No 2, p 163-165, 1980.

Descriptors: *Water pollution prevention, *Water pollution control, *Water quality control, *Conferences, *International commissions, Water policy, Water law, Water quality management, Environmental policy, Environmental protection, Public health.

A draft Declaration of Policy on Prevention and Control of Water Pollution, including Transboundary Pollution, was proposed by the Economic Commision for Europe (ECE) at the 11th session of the ECE Committee on Water Problems. The draft is based on a list of Principles for Cooperation of ECE members and calls for the preservation of the natural quality of surface and groundwater to protect public health while allowing for sufficient quantities of water for drinking, aquatic flora and fauna, industry, agriculture, animal consumption, and recreation. To do this government should implement pollution control measures as part of their national policy of environmental protection and establish laws to regulate the discharge of pollutants to surface water and groundwater. Governments should also reduce land based pollution of the sea by toxic waste dumping and decrease their exploitation of the sea around marshlands and estuaries. Economic incentive and educational programs should be introduced to discourage pollution. Finally, international cooperation to solve water problems is called for within the ECE. (Geiger-FRC)
W83-00797

DISTRIBUTIONAL CONSTRAINTS ON ACCEPTANCE OF NONPOINT POLLUTION CONTROLS,
Tennessee Univ., Knoxville. Dept. of Agricultural Economics and Rural Sociology.
For primary bibliographic entry see Field 6C.
W83-00829

SHALLOW DREDGING AS A STRATEGY FOR THE CONTROL OF SUBLITTORAL MACROPHYTES: A CASE STUDY IN TUGGERAH LAKES, NEW SOUTH WALES,
Victoria Ministry for Conservation, Queenscliff (Australia). Marine Science Labs.
L. C. Collett, A. J. Collins, P. J. Gibbs, and R. J. West.
Australian Journal of Marine and Freshwater Research, Vol 32, No 4, p 563-571, 1981. 3 Fig, 2 Tab, 24 Ref.

Descriptors: *Lake restoration, *Dredging, *Macrophytes, Tuggerah Lakes, New South Wales, *Australia, Shallow water, Lake sediments, Silt, Sand, Sedimentation, Benthic environment, Zostera capricorni, Ruppia megacarpa, Aquatic life.

The efficacy of dredging as a macrophyte control strategy was studied along with the effects of such an undertaking on the macrobenthic community. The nearshore regions of the Tuggerah Lakes, located on the central coast of New South Wales, were dredged to depths of 1.0 to 1.4 and 1.8 meters. The lakes comprise three interconnected coastal lagoons, are shallow, and have a negligible tidal range. Rainfall averages 1100 mm annually, tending to be episodic, with stream discharges into the lakes varying seasonally with common flooding. Catchments are primarily of sandstone with some shale and recent alluvial deposits. Lake sediments are mainly sand, clay and silts. Tributary streams draining into the lakes receive nutrients from a variety of sources, which stimulate microalgal and macrophyte growth. Sixty-three species of macrobenthic invertebrates were collected. The most abundant taxa were three species of amphipods, a gastropod, a bivalve, an unidentified but recognizable nemertean, and two species of polychaete. A substantial reduction in the number of macrobenthic invertebrates was noted at control sites about 4 months after dredging, corresponding to a sharply reduced salinity level throughout the lakes after heavy rainfall. Very little difference was noted between the size and composition of macrobenthic communities in control and the more deeply dredged plots in March, although there was a significant difference between controls and the 1.0 meter test plot. Eight months after dredging the sites appeared to have been recolonized at about the same densities and with the same species found in control areas. An analysis of sediments revealed that after dredging the deeper plots gradually filled with soft, unconsolidated, grey to black ooze which had a high organic content, composed mainly of macrophyte detritus. (Baker-FRC)
W83-00831

CREATION OF WETLAND HABITATS IN NORTHEASTERN ILLINOIS,
Resource Associates, Chicago, IL.
D. L. Hey, J. M. Stockdale, D. Kropp, and G. Wilhelm.
Illinois Department of Energy and Natural Resources Document No 82/09, May 1982. 117 p, 8 Fig, 19 Tab, 32 Ref.

Descriptors: *Wetlands, *Aquatic habitatat, *Nonpoint pollution sources, *Land reclamation, *Cost-benefit analysis, Rivers, Pollutants, Wastewater treatment, Runoff, Water quality, Water quality management, Flood-control storage, Surveys, Vegetation, Habitats, Wildlife habitats.

Most of northeastern Illinois' streams have been adapted to accommodate agricultural or urban development. As a result of channelization and floodplain filling, there has been loss of wetland and aquatic habitats, less flood water storage and limited use of the streams. Also, the impact of nonpoint sources of contaminants, which are not directed through wastewater treatment facilities, affects wetlands. This report addresses these problems and proposes a plan for a reconstructed wetland, which has a high pollutant removal efficiency. The criteria to select a demonstration site included geology, topography, soil, vegetation, wildlife, man-made changes and land-use. A site along the Des Plaines River was chosen and an inventory was taken of its soils, hydrology, water quality, animals, vegetation and public access/public use. Restoration will take 1-2 years and, ideally, will return the land to its original scheme. Once restoration is complete, management and operation demands are expected to be fairly low, particularly when compared to the benefits of improved water quality, flood storage, habitat, and recreational opportunities. Ongoing site monitoring will assess the changes occurring and will assure that some specific management requirements are met. Four cost components are considered when comparing reconstruction to traditional wastewater treatment: land acquistion, construction, pumping, and maintenance/operation. Three wetland treatment options are used. Each of these proposed options costs less then conventional treatment and provides benefits over and above improved water quality, which is all that conventional treatment offers. (Atkins-Omniplan)
W83-00944

THE FEASIBILITY AND BENEFITS OF RECLAIMING A MAN-MADE LAKE: A CASE STUDY OF LAKE PARADISE, MATTOON, ILLINOIS,
Illinois Univ. at Urbana-Champaign. Water Resources Center.
For primary bibliographic entry see Field 6B.
W83-00945

LIMING OF ACIDIFIED LAKES: INDUCED LONG-TERM CHANGES,
Swedish Water and Air Pollution Research Lab., Goeteborg.
H. Hultberg, and I. B. Andersson.
Water, Air, and Soil Pollution, Vol 18, No 1-3, p 311-331, 1982. 10 Fig, 3 Tab, 51 Ref.

Descriptors: *Lake restoration, *Acidity, *Lime, Oligotrophy, Lakes, Benthic environment, Macroinvertebrates, Zooplankton, Phytoplankton, Phosphorus, Neutralization, Algae, Eutrophication, *Sweden.

Long-term trends were examined after the neutralization of four acidified lakes in two regions on the Swedish west coast. Neutralization was achieved by a di-Ca-silicate with 52% Ca0 and about 11.5% Mg0. During a 5 to 7 year period between 61 and 74% of the spread lime product dissolved. The pH was increased from a range of 4.5 to 5.2 to near neutral, and alkalinity was restored in the range of 0.2 to 0.3 meq/liter. The Ca content was raised to 3 to 4 times what it had been before liming. Transparency decreased significantly in two lakes, presumably due to changed phytoplankton composition. These changes successively declined due to dilution and continuous acid loading. It was concluded that the use of lime products was an effective way to neutralize acidified lakes if properly administered. Changes were noted in water chemistry and fish populations as a consequence of biotic changes. Phytoplankton and zooplankton communities responded, and changes in benthic macroinvertebrate species occurred over several years. Most of the changes were the result of expanding populations of species which had been present at low concentration levels in the acid state of the lake. The previously noted decline of total P was not influenced by neutralization and may be mostly dependent on negative changes in the soils surrounding the lakes. This process could be an important factor for the oligotrophication of lakes in areas where acid deposition is high. (Baker-FRC)
W83-00958

STRUCTURE AND PRODUCTIVITY OF EPIPHYTIC ALGAL COMMUNITIES ON LOBELIA DORTMANNA L. IN ACIDIFIED AND LIMED LAKES,
Lund Univ. (Sweden). Limnological Inst.
S. Lazarek.
Water, Air, and Soil Pollution, Vol 18, No 1-3, p 333-342, 1982. 5 Fig, 1 Tab, 27 Ref.

Descriptors: *Algal growth, *Productivity, *Lakes, *Lake restoration, *Lime, Acidity, Algae, Diatoms, Detritus, Seasonal variation, *Sweden.

Seasonal changes were considered in the structure, biomass and rate of photosynthetic activity of epiphytic algae growing on Lobelia dortmanna L. (isoetides) in acidified and limed lakes in southwestern Sweden. Study sites included acidified and limed lakes in southwestern Sweden. Study sites included acidified Lake Gardsjon, and Lake Hogsjon, which was limed in 1978 and 1979. In both lakes a layer of firmly attached diatoms covered the Lobelia leaves. Scanning electron microscope study revealed a mucoid matrix and in L. Gardsjon heavy cover of detritus. The spring period of L. Gardsjon was characterized by the red alga Batrachospermum sp., which was followed by the appearance of Binuclearia sp. and Mougeotia spp. Blue-green algae appeared during the warmer periods of the year. L. Hogsjon in spring was characterized by desmids. Diatoms dominated the community in summer, while green algae appeared in the autumn. The biomass in L. Gardsjon showed spring and late summer maxima, while in L. Hogsjon it increased, gradually reaching a maximum in autumn. Chlorophyll a concentration was highest in L. Gardsjon in late summer. Primary productivity rates calculated per unit substrate surface area at 1.0 m depth were highest in early summer and decreased in late summer. The liming of L. Hogsjon apparently caused significant structural changes in the epiphytic community, favoring diatoms and green algae, especially desmids. Blue green algae were characteristics for L. Gardsjon, despite the lake's low pH. Productivity rates at 1.0 m depth show similar trends in both lakes. (Baker-FRC)
W83-00959

DETERMINATION OF GEOHYDRAULIC PARAMETERS AND THE INFILTRATION CAPACITY OF SAND BASINS FOR ARTIFICIAL GROUNDWATER ENRICHMENT (BESTIMMUNG DER GEOHYDRAULISCHEN PARAMETER UND DER INFILTRATIONSLEISTUNG VON SANDBECKEN BEI KUNSTLICHER GRUNDWASSERANREICHERUNG),
Institut fuer Wasserwirtschaft, Berlin (German, D.R.).
S. Kaden, K. Tiemer, and T. V. Burtschak.
Wasserwirtschaft-Wassertechnik, Vol 31, No 9, p 310-314, September 1981. 8 Fig, 9 Ref. (No English summary).

Descriptors: *Enrichment, *Sand basins, *Mathematical models, *Groundwater, *Infiltration capacity, Construction costs, Design criteria, Hydraulic design, Computer models, Costs, Operating costs, Geology, Geohydraulic parameters, *German Democratic Republic, USSR, Surface Water, Physical properties, Filtration, Percolation, Sand filters.

The main result of bilateral cooperation between the German Democratic Republic (GDR) and the USSR on the scientific basis of groundwater recharge from surface water to regulate flow, improve water quality, and promote rational use was a series of recommendations for the determination of geohydraulic parameters and the infiltration capability of sand basins. Infiltration basins are categorized according to method of construction (normal, simplified with no time limit, and simplified with time limit) and infiltration surface (sand, plants, gravel or pebble). Operation of the basin is determined by the water depth, water inflow, and operation time. The recommendations present design principles for infiltration models based on the laws of filtration of water with suspended solids as well as the laws of one-dimensional vertical filtration through two weakly permeable layers with water discharge into a highly permeable subsoil. The models corresponded satisfactorily with field and laboratory test results from both the GDR and the USSR. The geohydraulic parameters required to calculate infiltration are the thickness and filter resistance of the highly silted sand layer, the sludge-uptake capacity of the sand, and parameters for the characterization of the filter cake. The computer program SYSBAS was developed to compare different types of basin, study the influence of changes in geohydraulic parameters, optimize individual construction and operational parameters, and select operation regimes. An application of the program for the Koltschino (USSR) water works is described. Cooperation between the GDR and the USSR proved mutually beneficial with a 10-20% saving in building and operating costs for basin systems resulting from use of the models. Duplication of research was also avoided. (Gish-FRC)
W83-00983

U. S. GEOLOGICAL SURVEY STANDARD REFERENCE WATER SAMPLES FOR PESTICIDES,
Geological Survey, Lakewood, CO. Water Resources Div.
M. J. Fishman, L. C. Friedman, and D. K. Boyle.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-237009, Price codes: A03 in paper copy, A01 in microfiche.
Geological Survey Water-Resources Investigations 82-28, 1982. 28 p, 2 Fig, 4 Ref.

Descriptors: *Water quality standards, *Pesticides, *Water sampling, *Water analysis, Chemical analysis, Data collections, Statistical analysis.

The U.S. Geological Survey has been preparing and maintaining a library of standard reference water samplers for inorganic constitutents for 19 years. Recently, the reference sample program has been expanded to include pesticides and other organic materials. Two samples containing organochlorine and organophosphorus insecticides, and chlorophenoxy acid herbicides were distributed to a number of laboratories in the United States. One of the samples also contained Aroclors of PCB. Intralaboratory data obtained for these round-robin studies are presented along with interlaboratory data on long-term stability. (USGS).
W83-01005

VULNERABILITY MAPS: A PROMISING TOOL IN GROUNDWATER PROTECTION,
A. Villumsen, and C. Sonderskov.
Aqua, No 5, p 0466-0468, 1982. 2 Fig, 1 Ref.

Descriptors: *Groundwater management, *Water pollution prevention, *Water pollution control, Groundwater, Water supply, Planning, Maps, Hydrogeology, Water pollution sources, *Denmark.

Compared to surface water reservoirs, groundwater aquifers are naturally protected against microbiological and chemical contamination by the geological deposits above the aquifers. However, recent occurrences of groundwater contamination as a result of leakage from chemical disposals, landfills, agricultural land use and use of fertilizers make it necessary to consider the planning of groundwater protection. For this purpose the planners need relevant information on the vulnerability

of the aquifers with regard to pollution which occurs at the ground surface. The Geological Survey of Denmark has carried out a pilot project in which geological, hydrogeological, and chemical data has been used to produce vulnerability maps. Using the vulnerability maps, which at present are only preliminary, planners will be able to consider the risk of groundwater pollution before making decisions on localization of chemical and sewage disposals, landfills, land use, and other matters. The maps now available have been produced under assumptions not totally valid for water movement and chemical reactions in the unsaturated zone. (Baker-FRC)
W83-01012

DIFFUSED TYPE POLLUTION CONTROL FOR CATCHMENT AREAS OF RIVERS USED TO PROVIDE DRINKING WATER,
Institute for Environmental Management, Warsaw (Poland).
H. Manczak, and H. Szymanska.
Aqua, No 5, p 0479-0484, 1982. 9 Fig, 2 Tab, 16 Ref.

Descriptors: *Rivers, *Drinking water, *Water pollution control, Dams, Reservoirs, Biological treatment, Filtration, Ponds, Macrophytes, Fish, Microrecirculation, Water supply, *Poland.

Rivers being used to provide drinking water are subject to special control. Protective measures have to cover all types of pollution originating within catchment areas of the water intake, including both point and non-point source. Methods of protecting water against pollution from non-point sources include the construction of preliminary reservoirs by erection of anti-rubble dams on swift-flowing streams and rubble-dragging rivers. Low retention inter-field reservoirs can be constructed on streams and small rivers to collect water at a time of their rising and apply it for agricultural purposes during the remaining months, thus preventing fertilizer compounds from flowing further away from the area of application. Biological filters, algal/bacterial ponds with higher water plants and fish ponds, and systems of microrecirculation of matter and surface and underground waters are all methods of control. Nutrient balance creates a basis for water protection against pollution from non-point sources for catchment areas of rivers. The nutrient balance enables one to determine necessary degrees of phosphorus removal from both point type sources and nonpoint sources. (Baker-FRC)
W83-01031

INVESTIGATION INTO WATER EXCHANGE IN RESERVOIRS OF DIFFERENT SHAPES AND DIFFERENT ARRANGEMENT OF INLET AND DISCHARGE PIPES,
Kommunale Vereinigung fuer Wasser- und Abfallwirtschaft e.V., Stuttgart (Germany, F.R.).
A. Baur.
Aqua, No 5, p 0463-0465, 1982. 3 Fig, 13 Ref.

Descriptors: *Water exchange, *Reservoirs, *Water supply, Aeration, *Mixing, Odor control, Taste, Pipes, Water renewal, *Water quality control, *Design criteria.

The renewal of water in reservoirs is imperative for the supply of drinking water which is free of germs, odorless and is good tasting. Experiments were carried out in existing reservoirs to determine whether there is sufficient water exchange in reservoirs of different shapes and sizes and different arrangements of inlet and discharge pipes, whether improvement could be attained by simple measures, and whether expensive measures for displacement flow would result in better water exchange. Tests were made in reservoirs with a volume of 500 to 5000 cubic meters. All tests indicated that good mixing was accomplished, and thus the desired renewal of the water was accomplished, without costly measures. A simple arrangement of the inlet and discharge pipes guarantees the needed exchange. Based on this study recommendations are made for the design of reservoir inlets. (Baker-FRC)
W83-01035

6. WATER RESOURCES PLANNING

6A. Techniques Of Planning

A MONITORING/MODELING STRATEGY FOR 208 IMPLEMENTATION,
Purdue Univ., Lafayette, IN. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 5B.
W83-00890

6B. Evaluation Process

THE FEASIBILITY AND BENEFITS OF RECLAIMING A MAN-MADE LAKE: A CASE STUDY OF LAKE PARADISE, MATTOON, ILLINOIS,
Illinois Univ. at Urbana-Champaign. Water Resources Center.
G. E. Stout, R. Buhr, S. R. Deo, M. J. Barcelona, and J. Absher.
Research Report 170, July 1982. 39 p, 2 Fig, 11 Tab, 16 Ref.

Descriptors: *Lake restoration, *Lake sediments, *Cost-benefit analysis, *Estimated benefits, *Dredging, Reservoirs, Reservoir storage, Storage capacity, Water quality, Water supply, Economic evaluation, Recreation demand, Recreation, Artificial lakes, Indirect benefits, Topsoil.

About 30% of Illinois' reservoirs have severe sedimentation problems, which reduce storage capacities, degrade water quality and limit recreational activities. A pilot program at Lake Paradise, which lost 31.1% of its original storage capacity between 1908 and 1979, studied the feasibility and benefits of lake restoration. Many of the lake's water quality problems--algal blooms and turbidity--are traceable to sediment-associated nutrients and flows from nearby septic systems. Concentrations of trace elements in the river's lower reaches indicate that the lake is losing its sediment trap efficiency. The upper reaches are relatively pollution free; sediment in that area compares well with commercial soil amendments, thus making land applications of the dredged material suitable disposal practices. Judging from a questionaire sent to area residents, public opinion favors lake restoration, not only to maintain or improve water quality and quantity, but also to enhance recreational opportunities. Residents also felt that the lake could serve as an environmental learning tool. There are economic benefits to reclaiming the lake, such as improved water supply, a reduction in water treatment, improved recreational opportunities, and reuse of the sediment as agricultural topsoil. The main alternative to reclaiming the lake is to build a new reservoir, which could cost $350,000 or more. Reclamation is projected at $119,000 per year but this figure does not include the economic value of the benefits, which could be as high as $40,000 annually. These results suggest that combining restoration and management techniques may solve some of Illinois' reservoir problems. (Atkins-Omniplan)
W83-00945

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

REDUCING THE COST OF WATER POLLUTION CONTROL UNDER THE CLEAN WATER ACT,
Missouri Public Service Commission, St. Louis.
For primary bibliographic entry see Field 6E.
W83-00757

DISTRIBUTIONAL CONSTRAINTS ON ACCEPTANCE OF NONPOINT POLLUTION CONTROLS,
Tennessee Univ., Knoxville. Dept. of Agricultural Economics and Rural Sociology.
W. M. Park, and L. A. Shabman.
American Journal of Agricultural Economics, Vol 64, No 3, p 455-462, August, 1982. 2 Fig, 2 Tab, 11 Ref. OWRT A-085-VA.

Descriptors: *Nonpoint pollution sources, *Cost-benefit analysis, *Federal jurisdiction, Water pollution control, Water policy, Water quality, Economic aspects.

A theoretical argument is presented that federal cost-sharing programs for nonpoint pollution control will be limited and require areas to raise their own revenues. These local revenues could then be used as inducements for the implementation of non-point control practices. The 208 agency staff would estimate the distribution of costs and water benefits associated with the least cost strategy for meeting an explicit water quality goal. Then, agreement would be sought with water quality beneficiaries (for example, water supply or recreational authorities) on ways to raise funds to be paid as inducements. A linear programming model is applied for an emperical case analysis of the Occoquan Basin in Northern Virginia. (Small-FRC)
W83-00829

SOCIOECONOMIC VALUE OF THE TROUT FISHERY IN LAKE TANEYCOMO, MISSOURI,
Missouri Dept. of Conservation, Columbia.
A. S. Weithman, and M. A. Haas.
Transactions of the American Fisheries Society, Vol 111, No 2, p 223-230, March, 1982. 2 Fig, 5 Tab, 24 Ref.

Descriptors: *Fisheries, *Economic aspects, *Water demand, Fish farming, Fish managment, Economic evaluation, Cost analysis, *Lake Taneycomo, *Missouri, *Trout, Fish populations, Reservoirs, Artificial lakes, Lakes, Water resources managment, Water quality.

The socioconomic value of the Lake Taneycomo fishery for raninbow trout Salmo gairdneri was examined. The discharge of oxygen deficient water from upstream Table Rock Lake each fall has affected fishing since the fishery was established in the late 1950s. The low oxygen problem became acute and threatened the trout fishery in the 1970s. Lake Taneycomo is a hydroelectric reservoir, created in 1913 through the impoundment of the White River. The lake is 32 km long, with a surface area of 700 ha and a maximum depth of 12 m. Three methods were used for estimating the value of the fishery: replacement cost of fish; travel cost; and income multiplier. Information for the latter two methods was based on 500 angler interviews. Replacement cost of the rainbow trout would be $0.5 million. The travel-cost method provided an estimate of $2.9 million for the value of the fishery to anglers (consumers' surplus). The income-multiplier method provided an estimate of $9.9 million for the net economic benefit the local economy, or about 7% of the economic activity of the area. The benefit: cost ratio of the rainbow trout stocking program at Lake Taneycomo was 22:1 for the local economy. (Baker-FRC)
W83-00872

REPORT ON ASSESSMENT OF LOW-HEAD HYDROELECTRIC SITES IN THE WESTERN STATES; METHOLOGY AND SUMMARY.
Tudor Engineering Co., Denver, CO.
Bureau of Reclamation Report, March 1982. 71 p, 14 Fig, 7 Tab, 5 Ref.

Descriptors: *Hydroelectric plants, *Site selection, *Cost analysis, *Low head, Environmental effects, Social impact, Economic aspects, Hydrologic aspects, Geology, Access routes, River flow.

At the conclusion of Phase II of the Low-Head Hydroelectric Evaluation and Inventory, 86 low-head sites were selected for more detailed technical and economic analyses. Phase III of the study, which is the subject of this report, consisted of site-specific studies for the 86 sites, including preliminary designs, cost estimates and economic analyses. Each site was visited and a field data form was completed which included the physical site fea-

tures, geological characteristics, site access considerations, environmental assessment rating, and social impact rating. The hydrology data for each site were collected and assembled, and the power studies were conducted so that the power plants could be sized and the generating units could be selected. A basic assumption made in the power studies was that all of the power plants will be run-of-the-river plants, and that no changes will be made in the river flow patterns. Preliminary designs and layouts were prepared for each site and cost estimates were made from the preliminary layouts and appraisal level cost estimating curves. An evaluation of the economic value of hydroelectric power was made on a regional basis for the market area, and a benefit-cost analysis was made for each site. For the 57 economically feasible sites, the total installed capacity will be about 598,000 kilowatts, The installed capacity sizes selected range from about 1,200 kilowatts to 30,000 kilowatts with 34 of the sites greater than 5,000 kilowatts, and 21 of the sites greater than 10,000 kilowatts. Economic studies of the 30,000 kilowatt maximum capacity plants indicated that larger capacities may be economically justified in future more detailed studies. The average annual energy potential of the 57 economically feasible sites is estimated to be about 3,300 gigawatt-hours. (Moore-SRC)
W83-00922

APPENDIX TO REPORT ON ASSESSMENT OF LOW-HEAD HYDROELECTRIC SITES IN THE WESTERN STATES; EVALUATION REPORTS FOR LOW-HEAD HYDROELECTRIC SITES, PART I - CALIFORNIA.
Tudor Engineering Co., Denver, CO.
For primary bibliographic entry see Field 8A.
W83-00923

APPENDIX TO REPORT ON ASSESSMENT OF LOW-HEAD HYDROELECTRIC SITES IN THE WESTERN STATE; EVALUATION REPORTS FOR LOW-HEAD HYDROELECTRIC SITES, PART II - COLORADO.
Tudor Engineering Co., Denver, CO.
For primary bibliographic entry see Field 8A.
W83-00924

APPENDIX TO REPORT ON ASSESSMENT OF LOW-HEAD HYDROELECTRIC SITES IN THE WESTERN STATES; EVALUATION REPORTS FOR LOW-HEAD HYDROELECTRIC SITES, PART III - IDAHO AND UTAH.
Tudor Engineering Co., Denver, CO.
For primary bibliographic entry see Field 8A.
W83-00925

APPENDIX TO REPORT OF ASSESSMENT OF LOW-HEAD HYDROELECTRIC SITES IN THE WESTERN STATES; EVALUATION REPORTS FOR LOW-HEAD HYDROELECTRIC SITES, PART IV - KANSAS, NEW MEXICO, OKLAHOMA, AND TEXAS.
Tudor Engineering Co., Denver, CO.
For primary bibliographic entry see Field 8A.
W83-00926

APPENDIX TO REPORT ON ASSESSMENT OF LOW-HEAD HYDROELECTRIC SITES IN THE WESTERN STATES; EVALUATION REPORTS FOR LOW-HEAD HYDROELECTRIC SITES, PART V - MONTANA AND WYOMING.
Tudor Engineering Co., Denver, CO.
For primary bibliographic entry see Field 8A.
W83-00927

APPENDIX TO REPORT ON ASSESSMENT OF LOW-HEAD HYDROELECTRIC SITES IN THE WESTERN STATES; EVALUATION REPORTS FOR LOW-HEAD HYDROELECTRIC SITES, PART VI - OREGON AND WASHINGTON.
Tudor Engineering Co., Denver, CO.
For primary bibliographic entry see Field 8A.
W83-00928

6D. Water Demand

WATER FROM POWER: WATER SUPPLY AND REGIONAL GROWTH IN THE SANTA CLARA VALLEY,
California Univ., Berkeley.
R. A. Walker, and M. J. Williams.
Economic Geography, Vol 58, No 2, p 95-119, 1982. 7 Fig, 3 Tab, 58 Ref.

Descriptors: *Water resources development, *Planning, Water supply, Water demand, Water management, Water supply development, *Santa Clara Valley, *California, Water table, Water availability, Political aspects, Economic aspects.

The history of water development in the Santa Clara Valley is reviewed. The major thesis examined is that the demand for water arising from agricultural and urban growth is the dominant variable, and that a political growth coalition has operated to see that water shortages and costs do not stand in the way of local development. The water supply history of Santa Clara County can be divided into three phases: extensive agriculture, irrigated agriculture and urban. By 1936 six dams had been completed to alleviate the falling water table. In 1943-45, poor rainfall and war industry development caused increased demands to be made on the water supply. Water demand was not lessened by increasing urbanization. Currently the San Jose metropolitan area is unique among major California cities in that it relies for most of its water delivery on private companies. Several Santa Clara County cities have municipal water systems. Water supply and delivery policies in the Santa Clara Valley have been geared to facilitate agricultural and urban growth, even to promote it. Steps taken in the Valley warn against simplistic interpretations of water resource development. Interpretations of behavior based on such institutional factors as bureaucratic rivalry ad explanations attending only to the economics of supply and demand are inadequate. Water must be understood in terms of the political economy of regional growth in which the wealth and other rewards of capital accumulation are the motivation, the business class is the central mobilizing force, and the successful growth coalition is the means by which aggressive water supply politics are generated and water resources are developed for local gain. (Baker-FRC)
W83-00795

ECE SEMINAR ON WATER UTILIZATION RECOMMENDS GIVING WATER MANAGEMENT POLICIES HIGH PRIORITY.
International Journal of Environmental Studies, Vol 15, No 2, p 165-168, 1980.

Descriptors: *Water pollution prevention, *Water quality control, *International commissions, *Water management, *Water use efficiency, *Water reuse, Water pollution control, Water policy, Water law, Water quality managment, Water use, Conferences, Environmental policy, Environmental protection.

Water is recognized as a limiting factor in the economic growth of many Economic Commission for Europe (ECE) countries. A Seminar on Rational Utilization of Water held by the ECE in Leipzig in 1979 made a number of recommendations for efficient water utilization. The implementation of national policies for the rational use of water should be given priority in ECE countries. Legal provisions should be made to carry out this objective. River basin management is needed for water pollution control. The multi-purpose uses of water should be considered along with their impact on other natural resources. The economics of water utilization should be balanced with the protection of the quality of life. A financial program should be set up to provide a source of income to the water regulatory authorities. Strict regulatory measures should be provided to control hazardous pollutants and the managment of cooling water use. National policies should support research of wastewater reuse and advanced irrigation techniques. Water personnel should be well trained to optimize new technologies and the public should be educated on water conservation and pollution prevention. (Geiger-FRC)
W83-00796

WATER-LEVEL TRENDS, PUMPAGE, AND CHEMICAL QUALITY IN THE CAMBRIAN-ORDOVICIAN AQUIFER IN ILLINOIS, 1971-1980,
Illinois State Water Survey Div., Champaign.
R. T. Sasman, C. R. Benson, R. S. Ludwigs, and T. L. Williams.
Illinois Department of Energy and Natural Resources Circular 154, 1982. 64 p, 23 Fig, 5 Tab, 19 Ref, 2 Append.

Descriptors: *Aquifers, *Water level fluctuations, *Pumpage, *Water quality, *Groundwater depletion, Water yield, Water supply, Groundwater recharge, Dewatering, Well data, Deep wells, Water depth, Water level, *Illinois, Chicago.

Increasing withdrawals, declining water levels and objectional chemicals in the Cambrian-Ordovician aquifer are causing grave concerns about its capability to continue providing a major portion of northeastern Illinois' water supply. This report considers 1971-80 pumpage and water level changes, and 1980-81 water quality in the deep sandstone wells penetrating the state's most highly developed aquifer for groundwater supplies. Data covering 48% of the state, with emphasis on the Chicago area, are discussed. From 1971 to 1980, production from deep wells increased 12% (to 267.5 mgd); in Chicago, pumpage increased 22% to 183.7 mgd. Excessive water-level declines are occurring in the Chicago area, and during the 1975-1980 period ranged from 1 ft/yr to 14 ft/yr with an average of 9 ft/yr. Data from 10 wells outside Chicago for the same period varied from a rise of 3.2 ft/yr to a decline of 4.4 ft/yr. Since 1958, the Chicago area withdrawals have exceeded the aquifer's sustained yield. By 1971, the upper and some middle units of the aquifer had been dewatered in some areas, with some pumpage levels exceeding 1000 feet. By 1980, at least 48 pumps were set at 1000 feet or deeper. If withdrawals continue increasing, the aquifer's principal water yielding units will be selectively dewatered much sooner than anticipated. The chemical analyses of samples taken between October 1980 and May 1981 indicate a degradation of quality away from the major recharge areas. This is based on distributions of iron, sodium, chloride, sulfate, hardness, and total dissolved solids. The poorest quality waters are in the Chicago area and in the southwestern part of the study area. (Atkins-Omniplan)
W83-00947

FORECASTING SHORT-TERM REVENUES FOR WATER AND SEWER UTILITIES,
Johns Hopkins Univ., Baltimore, MD. Dept. of Geography.
J. J. Boland, R. W. Wentworth, and R. C. Steiner.
Journal of the American Water Works Association, Vol 74, No 9, p 460-465, September, 1982. 2 Fig, 4 Tab, 11 Ref.

Descriptors: *Water use, *Income, *Forecasting, Utilities, Model studies, Sewer systems, Temperature, Precipitation, Weather, Water deficit, Seasonal variation, *Washington Suburban Sanitary Commission, Planning, District of Columbia, *Maryland.

A computer model for predicting water use, and in turn water revenues, was developed and placed in operation by the Washington Suburban Sanitary Commission (WSSC) in October 1980. The model uses variables (climatic, sociodemographic, and economic) to forecast upper and lower levels of revenues in the WSSC for the next 24 months. Climatic variables, especially summer temperature, precipitation, and moisture deficit, have a profound effect on seasonal water use. On occasion other variables are important--industrial process changes, prices of water and sewer services, population, number of dwelling units, and service connections. The total revenue forecast for the 1981 fiscal year was $100.35 million; actual revenues were $103.95 million. Predicted water use was 439.81 ML per

day; actual, 438.49 ML per day. Actual sewer revenues were $3.2 million more than predicted. Moisture deficits for this period were somewhat higher than predicted. (Cassar-FRC)
W83-01042

6E. Water Law and Institutions

OCEAN DUMPING OF SEWAGE SLUDGE: THE TIDE TURNS FROM PROTECTION TO MANAGEMENT,
Harvard Law School, Cambridge, MA.
W. L. Lahey.
Harvard Environmental Law Review, Vol 6, No 2, p 395-437, 1982.

Descriptors: *Ocean dumping, *Sludge disposal, *Reviews, Legal aspects, Environmental effects, Land disposal, Public health, Waste disposal.

The regulation of ocean dumping of sewage sludge under the Ocean Dumping Act both illustrates the problems associated with ocean dumping in general and affords an illuminating case history of environmental policymaking. EPA efforts to regulate ocean dumping of sewage sludge are herein reviewed. Ecological problems caused by such dumping are considered including depletion of dissolved oxygen, endangering marine organisms, and reducing the diversity of benthic communities. The development during the 1970s of a restrictive national policy toward sludge dumping is traced with special reference to the 1970 CEQ report, the Ocean Dumping Act and the International Dumping Convention, the 1973 Ocean Dumping Criteria, and the 1977 Revised Ocean Dumping Criteria. Factors which have prompted a reconsideration of that policy and analyses of the current status of sludge dumping regulation are cited. Some of the problems encountered with alternative disposal methods have included environmental and health risks, regulatory restrictions, cost factors and environmental damage. The future of ocean dumping of sewage sludge is discussed considering environmental and economic effects of land-based disposal operations, the ocean's ability to assimilate waste as it concerns site selection and assimilative capacity. It is concluded that increased scientific and regulatory attention should be directed toward identifying the conditions under which sludge and other wastes can be dumped into the ocean without causing unacceptable damage. (Baker-FRC)
W83-00732

REDUCING THE COST OF WATER POLLUTION CONTROL UNDER THE CLEAN WATER ACT,
Missouri Public Service Commission, St. Louis.
M. Rothfelder.
Natural Resources Journal, Vol 22, No 2, p 407-421, April, 1982. 104 Ref.

Descriptors: *Water pollution control, *Economic aspects, *Legal aspects, Clean Water Act, Regulations, Effluent charges, Cost estimates.

Criticism of the costs that the present system of water pollution regulation requires is discussed. Regulatory changes which would reduce the aggregate cost of pollution control are considered. It is assumed that achievement of cost reduction should not compromise the equitable treatment of dischargers and potential dischargers or the attainment of specified water quality. The potential for incorporating the proposed regulatory changes into the confines of the Clean Water Act is assessed. At present water pollution regulation systems focus on treatment by the individual, ignoring the aggregate cost of pollution control. Economists have proposed three methods to create pollution control systems which cost less than the present one: effluent charges, marketable effluent permits, and private ownership of the waterway. Of these methods, only the marketable permit system has any potential for use within the Clean Water Act. Under the act, EPA could not implement an initial sale of such permits, but a state administering its own permit system could. Either agency could allow transfer of permits after issuance if upon each transfer they required the procedural safeguards required by the Act. Requiring the safeguards would, however, diminish the system's ability to lower pollution control costs. Whether an agency could allow transfer without the safeguards is unclear, but an EPA regulation allowing transfers under just one of the safeguards probably could not withstand a court challenge. (Baker-FRC)
W83-00757

FEDERAL NON-RESERVED WATER RIGHTS: FACT OR FICTION.,
G. K. King.
Natural Resources Journal, Vol 22, No 2, p 423-432, April, 1982. 44 Ref.

Descriptors: *Water rights, *Legal aspects, *Water resources development, Water supply, Water demand, Federal jurisdiction, Adjudication procedure.

Due to the sometimes occurring inapplicability of the reserved rights doctrine, the United States has been forced to develop new theories upon which it may base its claims to water rights in the western states. One such theory, the 'non-reserved' water rights theory, has been controversial, and a recent Department of Interior Solicitor's Opinion has argued that the theory has no legal basis. A case which could be the ultimate test for this theory is now in progress in Wyoming. While it is thought that the district court adjudication will probably leave undecided the question of who has ultimate control over unappopriated waters on the public domain, on appeal, this case may lead to a definitive decision on the existence of federal non-reserved water rights. The states base their argument on the impossibility of developing a coherent water policy if the federal government is allowed to appropriate water without regard for substantive state law. States also argue that the non-reserved water rights doctrine constitutes federal intervention into an area which has traditionally been within the states' control. The federal government will argue that its interest in having a uniform water management policy for all publicly owned lands throughout the west should be overriding consideration in the determination of this issue. Other methods exist for the federal government to obtain water rights. The government may conform to state procedural law and receive a water right in the same manner as any other private appropriator. The government could obtain rights by purchase and transfer or by condemnation. Or the government might argue adverse possession for some of its historical uses. (Baker-FRC)
W83-00767

THE AVAILABILITY OF PRIVATE REMEDIES FOR ACID RAIN DAMAGE,
Southwestern Univ. School of Law, Los Angeles, CA.
J. M. Fischer.
Ecology Law Quarterly, Vol 8, No 3, p 429-487, 1981. 2 Fig, 379 Ref.

Descriptors: *Acid rain, *Legal aspects, *Public rights, Public nuisance, Public policy, Public relations, Legislation, Law enforcement.

Legal aspects determining whether a person whose property has been injured by acid rain can maintain a private action for damages are considered. Assuming the initial questions involving jurisdictional and venue matters may be resolved, acid rain plaintiffs must next establish the liability of individual defendants for their injuries. Although acid rain can probably be linked generally to industrial sources, evidence is likely to prove insufficient to match acid rain with particular sources. Acid rain plaintiffs may nevertheless be able to establish liability, however, if the burden of proof on causation is shifted to the defendants, once injury to plaintiffs is demonstrated. Recent cases in some states suggest rationales for burden shifting that may apply in such acid rain cases. A cause for action on acid rain could be stated under existing law - specifically, under either state or federal common law of nuisance remedies. That these remedies could be made available without advancing new legal doctrine does not mean, however, that the judiciary would be willing to sanction such a cause for action. Lawsuits brought for acid rain damage would be complex and time consuming, and would entail significant costs for the courts. Acid rain poses a potentially enormous threat to the environment and thus presents issues of great importance to society. Many judges feel matters of this level are better addressed through legislative than judicial action. (Baker-FRC)
W83-00794

THE PERFORMANCE OF APPROPRIATIVE WATER RIGHTS SYSTEMS IN THE WESTERN UNITED STATES DURING DROUGHT,
Colorado Univ., Boulder. Dept. of Economics.
C. W. Howe, P. K. Alexander, and R. J. Moses.
Natural Resources Journal, Vol 22, No 2, p 379-389, April, 1982. 14 Ref.

Descriptors: *Water supply, *Drought, *Water rights, Legal aspects, Irrigation, Water demand, Economic aspects, Model studies, Water storage, Water distribution, Drainage basins.

An understanding of the actual and potential performance of appropriation systems of water rights during periods of water shortage is crucial to improved response to shortages. The principles of economically efficient water allocation among users are outlined, and a comparison is made of practices under appropriations doctrine with these principles, particularly to identify the sources of inefficiency during drought. Practices that have developed outside of approriations doctrine proper to avert some of these inefficiencies are noted. Some of these practices are the cooperative pooling of water within small drainage basins, water rental or water banking practices wherein groups of juniors paid seniors for the use of water, cooperative storage of water, and 'futile calls' on deliveries to certain seniors. Fundamental changes in water management institutions to further improve the efficiency of water allocation under the appropriation doctrine are discussed, including more flexible water ownership rules, acquisition and administration of water rights by conservancy districts, the establishment of a state or interstate agency that would make a market in water rights, development of climate information and forecasting programs specific to substate areas, and extension training and information programs which would teach the individual irrigator how and when to apply water more efficiently. (Baker-FRC)
W83-00882

ENERGY MARKET IMPACTS OF THE LEGAL DEFINITION OF GEOTHERMAL ENERGY IN THE WESTERN UNITED STATES,
New Mexico State Univ., Las Cruces.
P. McDevitt, and D. Wells.
Natural Resources Journal, Vol 22, No 2, p 391-406, April, 1982. 5 Fig, 5 Tab, 19 Ref.

Descriptors: *Geothermal resources, *Legal aspects, Resources development, Model studies, Temperature, *Western U.S.

The possible market constraint for geothermal energy based on legal concerns resulting from the lack of a viable statutory definition of geothermal energy across the states is considered. The evolution of existing definitions of geothermal energy is described for steam resources and hydrothermal resources. Due to an apparently growing support for the approach of defining geothermal energy in temperature limits, the energy market impacts of temperature based statutes is examined. The model which is introduced to estimate the market potential of non-electric uses of geothermal energy will be implemented to estimate the energy market impacts of one approach for defining geothermal energy which seems to have gained substantial support in recent years. The statutes examined define geothermal energy as all water in excess of a minimum designated temperature. Thus states will be able to distinguish between water being used for traditional consumptive purposes and those to be employed for energy applications. States wishing to promote geothermal energy development should designate the highest possible minimum temperature in order to avoid conflict between

traditional and energy water demands. The restrictive impacts of minimum temperature regulations upon geothermal energy development are felt in the earliest years following enactment of such legislation. The market impacts of proposed temperature based definitions vary markedly across states. (Baker-FRC)
W83-00883

MITIGATING DROUGHT THROUGH WEATHER MODIFICATION: SELECTED INSTITUTIONAL AND METEOROLOGICAL ISSUES IN TEXAS; VOLUME ONE, TEXAS ADVISORY COMMISSION ON INTERGOVERNMENTAL RELATIONS,
Texas Advisory Commission on Intergovernmental Relations, Austin.
For primary bibliographic entry see Field 3B.
W83-00914

THE POLITICS OF WATER POLLUTION CONTROL: A CASE STUDY OF THE CANADIAN FISHERIES ACT AMENDMENTS AND THE PULP AND PAPER EFFLUENT REGULATIONS, 1970,
King Alfred's Coll., Winchester (England).
J. W. Parlour.
Journal of Environmental Management, Vol 13, No 2, p 127-149, September, 1981. 2 Fig, 4 Tab, 50 Ref.

Descriptors: *Political aspects, *Water pollution control, *Legislation, *Canada, *Pulp and paper industry, Water quality standards, Standards, Effluent standards, Legal aspects, Fisheries Acts Amendments, Pulp and Paper Effluent Regulations, Decision making, Regulations, Public participation, Economic aspects.

The political aspects of Canada's water pollution control legislation enacted from 1970 to 1972 are revealed. The formation of 2 of the 7 pieces of water legislation (the Fisheries Act Amendments and the Pulp and Paper Effluent Regulations) are traced. It is shown that the government bureaucracy was able to define water pollution problems and control the application of pertinent knowledge to produce a pollution control system based on industry's perceptions of a technically and economically practicable system. Public participation in decision making is discouraged by the ministry's authoritative attitude and by barriers for access to government and industrial information. Decision making is in the hands of an elite group of non-elected officials supported by expert advisors, mostly from the industries being regulated. The government's soft line handling of industry's pollution problems reflected its perception of pollution control effects on economic growth, employment, and inflation. Evidence of this policy is seen in the choice of national vs. regional assimilative capacity standards, the difference in regulations for old and new paper mills, financial assistance for pollution control equipment, and delays and flexibility in implementing compliance schedules. (Cassar-FRC)
W83-00951

THE WATER SUPPLY IN SWITZERLAND, A SURVEY OF THE STRUCTURE,
Eidgenoessisches Amt fuer Umweltschutz, Bern (Switzerland).
For primary bibliographic entry see Field 5F.
W83-01016

6F. Nonstructural Alternatives

EXPERIENCE WITH THE EEC DIRECTIVE 75/440 ON THE QUALITY OF SURFACE WATER FOR DRINKING WATER PROCUREMENT IN THE MEMBER STATES (ERFAHRUNGEN MIT DER EG-RICHTLINIE 75/440 UBER DIE QUALITAT VON OBERFLACHENWASSER FUR DIE TRINK-WASSERGEWINNUNG IN DEN MITGLIEDSSTAATEN),
EUREAU - UNION of Water-Supplying Associations of Member Countries of the European Communities.
Gas-Wasserfach Wasser-Abwasser, Vol 122, No 12, p 555-560, December, 1981. 5 Fig. (No English Summary).

Descriptors: *Drinking water, *Surface water, *Water law, *Water quality control, *European Economic Community, Law enforcement, Potable water, Water quality standards, Public health, Legal aspects, Reservoirs, Storage reservoirs.

Problems in the application of the 1975 European Economic Community directives on the quality of surface water used for drinking water are discussed in this official EUREAU report. Water was divided into three categories according to quality: A1 (best), A2, and A3 (worst), with A3 being prohibited for drinking water use. The responsibility for choosing between using A3 water or not providing drinking water lies with the water supply enterprises, which is unfair. When the directives are translated into national law in the member countries, there is a tendency to prevent the use of A3 water rather than to strive for an improvement in water quality, and in some places (some Belgian and German authorities) the latter is ignored altogether. Only two of the five usual methods for extracting surface water are fully covered by the directives: direct extraction from running water and from dammed reserviors. Indirect extraction from storage reservoirs is problematic: and improvement in water quality takes place in a storage basin, and therefore from a health point of view the point of extraction should be considered the source; but if this is done there is no incentive to try to improve the quality of the river supplying the reservoir. Water procured through artificial enrichment and bank filtration is not covered by the directives. The improvement of water quality is likely to become stalled because the directives give no quality goal. There is no incentive for the improvement of waters that already meet or exceed standards, and some standards are too low. (Gish-FRC)
W83-00771

EXPANDED CRITERIA FOR THE ASSESSMENT OF WATER QUALITY IN RUNNING WATERS (ERWEITERTE KRITERIEN ZUE BEURTEILUNG DER WASSERBESCHAFFENHEIT IN FLIESSGEWASSERN),
Wasserwirtschaftsdirektion, Ccotthus (German, D.R.).
E. Clausnitzer, H. Bophme, and G. Grulich.
Wasserwirtschaft-Wassertechnik, Vol 31, No 9, 308-310, September, 1981. 1 Tab, 1 Ref. (No English Summary).

Descriptors: *Running waters, *German Democratic Republic, *Water quality standards, *Monitoring, Classification, Standards, Oxygen balance, Organic matter, Salts, Heavy metals, Water pollution control, Stream pollution, Water law, Seasonal variation.

The new German Democratic Republic standard TGL 22764 entitled 'Use and Protection of Water, Classification of the Water Quality of Running Waters' is described. The standard became binding on March 1, 1982. The standard assesses water quality by means of three categories: organic matter and oxygen balance, salt content, and miscellaneous criteria. It should allow a better assessment of water quality according to the latest knowledge and technology, a better setting of standards for the content of varioous substances in water, a basis for the reorganization of water districts, and a foundation for comparative studies of connected river basins. The classification of organic matter and oxygen balance is based on seasonal variation in the river and allows for backwash effects. Salt classification rests on ecological criteria. Tthe most important heavy metals and othe pollutants such as cyanide, phenols, and nitrate are included in the miscellaneous classification. Other important pollutants, such as organochloride compounds and pesticides are not included in the standard because they are difficult and costly to analyze in nonspecialized laboratories. The standard is considerably more stringent than the one it replaces. It provides a logical connection with the standards for lakes, both natural and artificial. (Gish-FRC)
W83-00977

6G. Ecologic Impact Of Water Development

ENVIRONMENTAL EFFECTS OF RIVER CHANNEL WORKS USED IN LAND DRAINAGE IMPROVEMENT,
Liverpool Univ. (England). Dept. of Zoology.
S. Swales.
Journal of Environmental Management, Vol 14, No 2, p 103-126, March, 1982. 2 Tab, 146 Ref.

Descriptors: *Channel improvement, *Environmental effects, *Drainage effects, *Aquatic habitats, Rivers, *Ecological effects, Water quality, Dredging, Fish, Invertebrates, Wildlife, Aquatic environment, Stream biota, Habitats, Aquatic life, Reviews, Flow patterns, Vegetation, Erosion, Riffles, Substrates, Channel erosion, Channel flow, Channel morphology, Channelization, Open channel drainage, Bank erosion, Water temperature, Aquatic weeds, Suspended sediments, Species diversity, Species distribution, Nutrients, Floods, Low flow, Minimum flow.

The effects of river channel modifications on the environment and the aquatic community are reviewed. The main activities carried out to improve land drainage are widening, straightening, deepening, and removal of obstructions. Secondary activities include vegetation removal and embankment construction. These works can severely affect the river environment and its associated wildlife. The physical and hydraulic effects of channel works include increased bank and channel erosion and sediment transport, reduction of river length, elimination of the pool-riffle pattern, higher peak discharges and lower minimum flows, changes in substrate characteristics (replacement of gravel with silt), changes in water temperature (higher summer maximum and lower winter minimum), reduction in water level, and degradation of water quality. These physical changes reduce the species numbers and diversity of invertebrates and fish, affecting their shelter, food supply, reproduction environment, water temperature, and water chemistry. River flow is one of the most important physical characteristics affecting fish and invertebrate distribution and abundance, severe floods and very low flows being extremely damaging to the community. High suspended solids levels are also very detrimental. Fish populations may recover from channel works in several years or not for 40 or more years. Invertebrates recover more rapidly, within several months. The conflict of interest between environmental conservation and land drainage improvement can only be reconciled through a multi-desciplinary approach. (Cassar-FRC)
W83-00952

7. RESOURCES DATA

7A. Network Design

RAINGAUGE NETWORK REDUCTION,
Ministry of Works and Development, Palmerston North (New Zealand).
J. Dymond.
Journal of Hydrology, Vol 57, No 1/2, p 81-91, May, 1982. 3 Fig, 1 Tab, 4 Ref.

Descriptors: *Rain gages, *Sampling, *Error analysis, Gages, Network design, Basins, Rangitawa Basin, *New Zealand.

A mathematical expression is derived from estimating the mean square error caused by spatial variation of rainfall. This is useful in reducing the size of larger rain gage networks while maintaining a tolerable error. The procedure is illustrated in an example of the Rangitawa Basins, New Zealand, in which one of five existing gages in the 15 km by 8 km wide region was eliminated. Using all 5 gages the root mean square error of basin rainfall was 4.5%; using only the Stanway gage, about 10%. (Cassar-FRC)
W83-00900

RAINFALL INTERSTATION CORRELATION FUNCTIONS IV. ON THE OCCURRENCE OF ZERO AND LESS-THAN-ZERO RESPONSE,
Instituut voor Culturrtechniek en Waterhuishouding, Wagening (Netherlands).
For primary bibliographic entry see Field 2B.
W83-00912

AN AUTOMATIC RECORDING RAINGAGE NETWORK FOR A CLOUD-SEEDING EXPERIMENT,
Commonwealth Scientific and Industrial Research Organization, Sydney (Australia). Div. of Cloud Physics.
D. A. Parkin, W. D. King, and D. E. Shaw.
Journal of Applied Meteorology, Vol 21, No 2, p 227-236, February, 1982. 9 Fig, 1 Tab, 8 Ref.

Descriptors: *Rain gages, *Automation, Networks, Remote control, Computers, Precipitation, *Cloud seeding, Weather modification.

Automatic recording rain gages have been designed and built for use in a cloud seeding experiment. Each unit consists of a siphoned tipping bucket connected with a monophonic cassette tape recorder. The resolution of the apparatus is 0.2 mm. Each cassette tape can record 3000 events. To prevent tape sticking during prolonged hot dry periods the tape is activated at 2400 hours each day. Using a current drain of 500 microA on standby, the battery life is greater than 6 months. Data on tapes is transmitted to a microcomputer. A network of 103 gages was used in western Victoria for two experimental seasons of about 8 months each. Over a 4.5 month period during which units were unattended, 6% of site days were lost due to unit failures, generally caused by jammed tapes. Several examples of the types of data produced from the network are given. In one test the rainfall for the network showed excellent agreement with a daily-read gage for the period August 1 to October 31, 1979. (Cassar-FRC)
W83-00950

MICROELECTRONICS - A DECISIVE MEDIUM FOR THE REALIZATION OF AUTOMATIC TELEMETRY NETWORKS FOR WATER MONITORING (DIE MIKROELEKTRONIK - EIN ENTSCHEIDENDES MITTEL BEI DER REALISIERUNG AUTOMATISCHER FERMNESSNETZE ZUE GEWASSERUBERWACHUNG),
Institut fuer Wasserwirtschaft, Berlin (German D.R.).
F. Kraft, H. Muller, W. Rummel, and P. Wolff.
Wasserwirtschaft-Wassertechnik, Vol 31, No 9, p 300-302, September, 1981. 2 Fig. (No English Summary).

Descriptors: *Automation, *Telemetry, *German Democratic Republic, *Computers, Microcomputers, *Water quality control, Data aquisition, Data transmission, Projections, Date collections, Data interpretation, Security, Monitoring, Water pollution control.

The use of microelectronics in the automation of water quality and quantity monitoring systems in the German Democratic Republic (GDR) is discussed. The functions expected to be performed by the K 1510 microcomputer system when it is installed in an experimental automatic telemonitoring network in the Berlin area are described. These include expansion of the existing water-quality monitoring system in the areas of data acquisition, supercharging, the registering,an increase in the realibility of the data, and labor saving. The connection between the automatic monitoring stations within the network and the branch office will be provided by the government developed and produced telemetry system, AQUATRANS. This consists of three components: AQUATRANS 'F' for the automatic teletransmission of monitoring data, announcements, orders, and ideal values; AQUATRANS 'S', a security system altering personnel to break-ins, mechanical failure, and excess concentration of pollutants in the water; and AQUATRANS 'U' devices to convert data to various transmission media (e.g., radio to telephone). The technical specifications of the system are given. The applications of a telemonitoring network supported by a microcomputer include not only aids to daily operation but also the compilation of hourly, daily, weekly, and yearly data in the areas of pollution levels, the transport of various substances, and waster levels for the preparation of trend analyses and projections, the setting of standards, and the determination of energy balance and metabolism. Regression and correlation analysis and model studies may also be performed by the computer. The GDR plans to build a network of about 10 automatic water-quality monitoring stations delivering 700,000 pieces of primary data per year. Simultaneous control of 100 water-quality and 100 water-level gages will produce an additional 100,00 pieces of primary data per year. (Gish-FRC)
W83-00975

7B. Data Acquisition

LOW-LEVEL AERIAL INFRARED IMAGES FOR INVENTORY OF AN IRRIGATED AREA,
Idaho Univ., Moscow. Dept. of Agricultural Engineering.
K. H. Yoo, and J. R. Busch.
Transactions of the ASAE, Vol 25, No 3, p 661-665, May/June, 1982. 4 Fig, 4 Tab, 6 Ref.

Descriptors: *Irrigation, *Aerial photography, Photography, *Infrared imagery, Remote sensing, *Idaho, Canals, Vegetation.

The use of low level color infrared images taken with KODAK AROCHROME infrared film to inventory a large irrigated area is described. The pictures were taken at 2450 meters above ground surface of over 23,000 ha agricultural land in southeastern Idaho. The color infrared transparencies were analyzed to determine crop types, irrigation system types, canals, laterals, and study area boundaries. The waterways were easily detected to give width, length, and exact location. Although crops and irrigation system types could be distinguished, problems existed in the reliability of differentiating among them. Alfalfa fields and handmove sprinkler systems were the most difficult to interpret. This fact agrees with the results of earlier studies. These objects could be distinguished after other crops and irrigation system types were identified. Ground truth data were obtained from several locations in the study area as base information used in the interpretation of the transparencies. The results obtained in this study would be useful for other studies such as ground water recharge, water balance, and water allocation in an irrigated area. The procedure requires expensive equipment and a trained interpreter. For reducing the total processing cost the images could be taken on a smaller scale, even from high altitude aircraft, without losing accuracy of the results. The total cost for all procedures was about $0.25 per ha. Furthermore, the film is a permanent record available for future studies of the same area. (Baker-FRC)
W83-00733

C-BAND RADAR FOR DETERMINING SURFACE SOIL MOISTURE,
Centre de Recherches en Physique de 1' Environnement, Issy-les Moulineaux (France).
R. Bernard, P. Martin, J. L. Thony, M. Vauclin, and D. Vidal-Madjar.
Remote Sensing of Environment, Vol 12, No 3, p 189-200, 1982. 6 Fig, 3 Tab, 11 Ref.

Descriptors: *Soil water, *Radar, *Remote sensing, Microwaves, Soil surface, Agricultural hydrology, *France, Paris.

The capability of the active microwave technique to measure surface soil moisture was studied in an agricultural area near Paris, France, in 30 m diameter circles in three types of surface: wheat stubble, sugar beet, and corn. This investigation, part of multiyear program, was designed to verify and use the results obtained by Ulaby et al. (1978, 1979). The radar was mounted on a crane boom, with a 16.5 m antenna and 11.7 sq m footprint surface. Parameters were 4.5 GHz, HH polarization, and 12 degrees incidence angle, relative to the vertical. The radar backscattering coefficient was a function only of the soil moisture relative to the field capacity, regardless of the nature of the soil and vegetation. A large part of the variability not explained by the regression came from spatial variability of the soil moisture. (Cassar-FRC)
W83-00735

DESIGN AND TESTING OF A NEW MICROLYSIMETER FOR LEACHING STUDIES,
Arizona Univ., Tucson. Dept. of Soils, Water, and Engineering.
R. J. Drake, I. L. Pepper, G. V. Johnson, and W. R. Kneebone.
Agronomy Journal, Vol 72, No 2, p 397-398, March-April, 1980. 2 Fig, 1 Tab, 6 Ref.

Descriptors: *Lysimeters, *Leaching, *Nitrates, *Nitrogen, *Soil water, Nutrients, Sampling.

A low cost, durabel microlysimeter was designed to study nitrogen leaching under perched water table conditions. The commonly available construction materials for the 71 cm long unit cost $3.60. A gravel-filled plastic collection bucket was placed in an 18 cm deep layer of pea gravel at the bottom of an open wooden box 46 cm x 46 cm square x 76 cm deep. The remainder of the box was filled with sand. An in-place collection tube reaching from the bucket to the surface of the sand allowed water from the bucket to be removed for analysis. Application of 0, 35, 70, and 140 kg nitrogen per ha as KN03 and daily leaching with water resulted in 97.6% nitrate recovery for all rates. The coefficient of variation was 8.5% between replicates. These data indicate the efficiency of this device for measuring leaching losses of N in soils under high water regimes and perched water table situations, such as golf courses. (Cassar-FRC)
W83-00821

A SCREEN-CAGED THERMCOUPLE PSYCHROMETER AND CALIBRATION CHAMBER FOR MEASUREMENTS OF PLANT AND SOIL WATER POTENTIAL,
Intermountain Forest and Range Experiment Station, Ogden, UT.
R. W. Brown, and J. M. Collins.
Agronomy Journal, Vol 72, No 5, p 851-854, September-October, 1980. 2 Fig, 16 Ref.

Descriptors: *Psychrometers, *Water potentials, *Thermocouples, Leaves, Soil water potential, Measuring instruments, Temperature gradient, Soil water, Plant water potential.

A new screen cage single junction psychrometer was designed to minimize the errors in estimating water potential with thermocouple psychrometers. The screen cage restricts the entry of contaminants into the psychrometer cavity, allows rapid vapor equilibration between sample and psychrometer, and provides a 360 degree concentric evaporation surface that reduces the influence of vapor condensation caused by temperature gradients. The themocouple consists of two copper leads and one constantan lead. One copper-constantan junction measures ambient temperatures; the other copper (positive)-constantan wires extend further into the screen cage. The entire unit is about 2 cm long and 1 cm in diameter. A unique stainless steel calibration chamber allows measurement of water potential of soil or plants. (Cassar-FRC)
W83-00827

A SIPHON DEVICE FOR FRACTIONATION OF RUNOFF SAMPLES,
Canterbury Univ., Christchurch (New Zealand). Dept. of Chemistry.
F. Downing, and H. K. J. Powell.
New Zealand Journal of Agricultural Research, Vol 23, No 2, p 257-258, 1980. 1 Fig, 2 Ref.

Descriptors: *Runoff, *Sampling, Nutrients, Water sampling, Water analysis, Agricultural runoff, Pollutant identification, Siphon.

A device for continuous fractionation and sampling of water collected in agricultural runoff ex-

periments is described. It is designed especially for situations in which sample volumes are large and samples are accumulated for 2-3 months. When full (1.5 liter), the all-glass device empties by siphon action, discharging 95% of the water and retaining 5% in a sample vessel for subsequent analysis. This is accomplished by a constriction in the outlet. Algal growth is inhibited by passing the solution through sparingly soluble HgI2. Devices have worked satisfactorily for 2 years, some for up to 6 months without servicing. (Cassar-FRC)
W83-00884

A FLOW-PROPORTIONAL SAMPLER FOR PLOT AND LYSIMETER STUDIES,
Institute of Hydrology, Wallingford (England).
P. M. Holdsworth, and G. Roberts.
Journal of Hydrology, Vol 57, No 3/4, p 389-393, June, 1982. 3 Fig, 4 Ref.

Descriptors: *Sampling, *Flow measurement, Monitoring, Control systems, Water sampling.

A volume-proportional sampler was developed to continuously collect representative samples for specified increments of flow. The apparatus, designed for sampling flow in 10 m square upland grass plots, records and samples surface flow, subsurface discharge, and rainfall. Each of four monitoring channels consists of four components: measurement and sample abstraction, control box, sample collection assembly, and logger. The discharge is collected in a 1.5 liter tipping bucket fitted with a mechanical tip counter. The sample abstractor is a small funnel which intercepts constant proportion of the discharge from alternate tips and passes a sample of a chosen increment to the collector. The battery-operated control bos uses CMOS integrated circuits. A switch selector allows a variety (4, 128, 256,..4096) of sample increments to be collected in each bottle before rotation of the sample collection assembly to the next bottle. The monitoring system has operated in the field for 3.5 years with a good record of data and sample return. (Cassar-FRC)
W83-00911

MEASUREMENT OF SNOW WATER STORAGE IN THE LAKE SUPERIOR BASIN USING AERIAL GAMMA-RAY SPECTROMETRY,
National Hydrology Research Inst., Ottawa (Ontario).
H. S. Loijens.
Canadian Water Resources Journal, Vol 5, No 4, p 40-54, 1980. 4 Fig, 2 Tab, 7 Ref.

Descriptors: *Remote sensing, *Spectrometers, *Snow cover, *Lake Superior, Aircraft, Snow water equivalent, Gamma radiation, Water storage, Runoff forecasting.

Aerial gamma ray spectrometry was used to measure snow water storage over the Lake Superior Basin on two surveys, November 22 and 16, 1977, and March 2 and 5, 1978 for the purpose of predicting inflow to the lake. Flightlines (36 separate lines over 1200 km) were over the center of clear cut areas. Background radiation measurements were taken over lakes about once an hour. Instrumentation consist4d of 4 thermally stabilized Harshaw hexagonal sodium iodide crystals; a 4-channel differential gamma ray spectrometer with energy windows set for integral, potassium, uranium, and thorium; altimeter; and tracking camera. The potassium channel was most accurate in measuring the snow water equivalents, which were 0-59 mm in November and 74-175 mm in March, according to ground surveys. Agreement of airborne results and ground measurements were generally good in spite of the considerable variability of gamma radiation in the Canadian Shield. Since the ground was not entirely snow-free in November at the time of the first measurements, the values obtained represented the increase in snow water equivalent rather than the total snow water equivalent. Errors in estimation of snow water equivalent were also introduced by waterlogging of soil, variation in surface radioactivity, terrain undulation, forest biomass, and insufficient background measurements. (Cassar-FRC)
W83-00965

7C. Evaluation, Processing and Publication

WATER QUALITY OF THE TIDAL POTOMAC RIVER AND ESTUARY, HYDROLOGIC DATA REPORT, 1980 WATER YEAR,
Geological Survey, Reston, VA. Water Resources Div.
S. F. Blanchard, R. H. Coupe, Jr., and J. C. Woodward.
Available from OFSS, USGS, Box 25425, Fed. Ctr., Denver, CO 80225. Paper copy $43.50; Microfiche $3.50. Geological Survey Open-File Report 82-152, 1982. 330 p, 7 Fig, 1 Tab, 22 Ref, 4 Append.

Descriptors: *Water quality, *Tidal rivers, *Estuaries, *Data collections, Physical properties, Chemical properties, Sampling, Sites, Cross sections, Water anlaysis, Dissolved solids, Sediments, Dissolved oxygen, Saline water, *Potomac River.

This report contains data on the physical and chemical properties measured in the Tidal Potomac River and Estuary during the 1980 Water Year. Data were collected routinely at five stations, and periodically at 17 stations including three stations near the mouth of the Potomac River in Chesapeake Bay. Each of the five stations represent a cross section through which the transport of selected dissolved and suspended materials can be computed. The remaining stations represent locations at which data were collected for special synoptic studies such as salt water migration, and dissolved oxygen dynamics. Routinely, samples were analyzed for silica, nitrogen, phosphorus, chlorophyll-a, pheophytin, and suspended sediment. Additional samples were analyzed for organic carbon, calcium, manganese, magnesium, sodium, alkalinity, sulfate, iron, potassium, chloride, fluoride, seston, algal growth potential, adenosine triphosphate, nitrifying bacteria and dissolved-solids residue. In addition, solar radiation measurements and in-situ measurements of dissolved oxygen, specific conductance, pH, temperature, and Secchi disk transparency are reported. (USGS)
W83-00984

WATER TYPE AND SUITABILITY OF OKLAHOMA SURFACE WATERS FOR PUBLIC SUPPLY AND IRRIGATION. PART 2: SALT FORK ARKANSAS RIVER AND CIMARRON RIVER BASINS THROUGH 1978,
Geological Survey, Oklahoma City, OK. Water Resources Div.
J. D. Stoner.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-240250, Price codes: A08 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 81-39, 1982. 150 p, 6 Fig, 3 Tab, 15 Ref.

Descriptors: *Water supply, *Irrigation, *Surface water, *Data collections, *Water quality, Water analysis, Trace elements, Hardness, Water use, *Oklahoma, Salt Fork Arkansas basin, Cimarron River basin.

Water-quality data in the Salt Fork Arkansas and Cimarron basins are examined for water type and suitability for public water supply and for irrigation use. The classification of water type is based on the relation of the major ions: calcium, magnesium, sodium, bicarbonate, carbonate, sulfate, and chloride to each other within the range of measured specific conductance. The evaluation of suitability for use as a public supply is based on the concentration levels and distribution of selected constituents. The Wilcox irrigation classification scheme is used to relate sodium concentrations and the salinity distribution to the use of the water for irrigation. The possibility of boron phytotoxic effects is discussed where data are available. (USGS)
W83-00989

HYDROLOGY OF THE PRAIRIE DOG CREEK DRAINAGE BASIN, ROSEBUD AND BIG HORN COUNTIES, MONTANA,
Geological Survey, Helena, MT. Water Resources Div.
N. E. McClymonds.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-124850, Price codes: A03 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 81-37, March 1982. 64 p, 15 Fig, 12 Tab, 18 Ref.

Descriptors: *Hydrology, *Streamflow, *Coals, *Data collections, Surface water, Groundwater, Water quality, Chemical analysis, Aquifers, Observation wells, Water level fluctuations, Flow characteristics, *Montana, Prairie Dog Creek, Tongue River.

The Prairie Dog Creek drainage basin in southeastern Montana was investigated during 1978-79 to establish a basic understanding of its surface-water and ground-water resources and the quality of water in an area having coal-mining potential. The principal minable coal is the 40-to 60-foot-thick Wall and lower Wall coal beds near the middle part of the Tongue River Member of the Fort Union Formation (Paleocene age). Prairie Dog Creek, which originates from springs and seeps from coal and sandstone layers, maintained perennial flow in its upstream and middle reaches then lost flow until the channel near its mouth had only standing water or was dry. The dissolved-solids concentration of streamwater during periods of high flow (1 cubic foot per second) ranged from 700 to about 1,000 milligrams per liter and during periods of lesser flow (0.5 cubic foot per second) ranged from about 1,300 to 1,600 milligrams per liter. Relatively clean sandstone aquifers had transmissivities of about 15 feet squared per day and water of the magnesium sulfate or sodium sulfate type, with dissolved-solids concentrations ranging from about 2,200 to 3,000 milligrams per liter; the water was of a sodium sulfate type and ranged from 1,820 to 4,190 milligrams per liter. The Brewster-Arnold coal aquifer had transmissivities similar to the Wall coal but its water was of a different type, sodium bicarbonate; it also contained large concentration of fluoride (more than 10 milligrams per liter) and had a very high sodium-adsorption ratio (more than 60). (USGS)
W83-00990

WATER RESOURCES DATA, IDAHO, WATER YEAR 1981--VOLUME 2. UPPER COLUMBIA RIVER BASIN AND SNAKE RIVER BASIN BELOW KING HILL.
Geological Survey, Boise, ID. Water Resources Div.
Geological Survey Water-Data Report ID-81-2, 1982. 379 p, 22 Fig.

Descriptors: *Hydrologic data, *Surface water, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Wells, Water level, Data collections, Sites, *Idaho, Columbia River basin, Snake River basin.

Water resources data for the 1981 water year for Idaho consist of records of stage, discharge, and water quality of streams; stage; contents, and water quality of lakes and reservoirs; and water levels and water quality of ground water. This report in two volumes contains discharge records for 204 gaging stations; stage only records for 2 gaging stations; stage only for 11 lakes and reservoirs; contents only for 16 lakes and reservoirs; water quality for 84 gaging stations, 77 partial-record stations, 138 wells, and 5 precipitation sites; and water levels for 469 observation wells. Also included are data for 38 crest-stage partial-record stations. Additional water data were collected at various sites, not involved in the systematic data-collection program, and are published as miscellaneous measurements. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in Idaho. (USGS)
W83-00993

WATER RESOURCES DATA, MICHIGAN, WATER YEAR 1981.

Geological Survey, Lansing MI. Water Resources Div.
Geological Survey Water-Data Report MI-81-1, 1982. 524 p, 9 Fig.

Descriptors: *Hydrologic data, *Surface water, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Wells, Water level, Data collection, Sites, *Michigan.

Water resources data for the 1981 water year for Michigan consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels and water temperature of ground water. This report contains discharge records for 178 gaging stations, stage only records for 4 gaging stations, stage and contents for 5 lakes and reservoirs, water quality for 45 continuous-record stations, and water levels for 53 observation wells. Also included are 85 crest-stage partial-record stations and 59 low-flow partial-record stations. Additional water data are published as miscellaneous measurements. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in Michigan. (USGS)
W83-00994

WATER RESOURCES DATA, COLORADO, WATER YEAR 1981--VOLUME 1. MISSOURI RIVER BASIN, ARKANSAS RIVER BASIN, AND RIO GRANDE BASIN.
Geological Survey, Lakewood, CO. Water Resources Div.
Geological Survey Water-Data Report CO-81-1, 1982. 487 p, 6 Fig, 4 Tab, 40 Ref.

Descriptors: *Hydrologic data, *Surface water, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Wells, Water level, Data collections, Sites, *Colorado, Missouri River basin, Arkansas River basin, Rio Grande basin.

Water-resources data for Colorado for the 1981 water year consists of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs, and water levels and water quality of wells and springs. This report (Volumes 1, 2, and 3) contains discharge records for about 460 gaging stations, stage and contents of 22 lakes and reservoirs, 4 partial-record low-flow stations, 30 crest-stage partial-record stations, and 50 miscellaneous sites; water quality for 163 gaging stations and 300 miscellaneous sites; and water levels for 55 observation wells. A few pertinent stations in bordering States also are included in this report. These data represent that part of the National Water Data System collected by the U.S. Geological Survey and cooperating State and Federal agencies in Colorado. (USGS)
W83-00995

WATER RESOURCES DATA, COLORADO, WATER YEAR 1981--VOLUME 2. COLORADO RIVER BASIN ABOVE DOLORES RIVER.
Geological Survey, Lakewood, CO. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-105098, Price codes: A16 in paper copy, A01 in microfiche.
Geological Survey Water-Data Report CO-81-2, 1982. 354 p, 6 Fig, 4 Tab, 40 Ref.

Descriptors: *Hydrologic data, *Surface water, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Wells, Water level, Data collections, Sites, *Colorado, Colorado River.

Water-resources data for Colorado for the 1981 water year consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs, and water levels and water quality of wells and sprints. This report (Volumes 1, 2, and 3) contains discharge records for about 460 gaging stations; stage and contents of 22 lakes and reservoirs, 4 partial-record low-flow stations, 30 crest-stage partial-record stations, and 50 miscellaneous sites; water quality for 163 gaging stations and 300 miscellaneous sites; and water levels for 55 observation wells. A few pertinent stations in bordering States also are included in this report. These data represent that part of the National Water Data System collected by the U.S. Geological Survey and cooperating State and Federal agencies in Colorado. (USGS)
W83-00996

WATER RESOURCES DATA, PENNSYLVANIA, WATER YEAR 1981--VOLUME 3. OHIO RIVER AND ST. LAWRENCE RIVER BASIN.
Geological Survey, Harrisburg, PA. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-107128, Price codes: A14 in paper copy, A01 in microfiche.
Geological Survey Water-Data Report PA-81-3, 1982. 314 p, 7 Fig.

Descriptors: *Hydrologic data, *Surface water, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Wells, Water level, Data collections, Sites, *Pennsylvania, Ohio River basin, St. Lawrence River basin.

Water resources data for the 1981 water year for Pennsylvania consist of records of discharge and water quality of streams, elevation and contents of lakes and reservoirs, and water levels of groundwater wells. This volume contains records for water discharge at 86 gaging stations, elevations and contents at 3 lakes and reservoirs, water quality at 35 gaging stations, and water levels at 20 observation wells. Also included are data for 11 crest-stage, 7 low-flow, and 322 water-quality partial-record stations. Additional water data were collected at various sites not involved in the systematic data-collection program and are published as miscellaneous measurements and analyses. These data together with the data in Volumes 1 and 2 represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State, local and Federal agencies in Pennsylvania. (USGS)
W83-00997

WATER RESOURCES DATA, PENNSYLVANIA, WATER YEAR 1981--VOLUME 2. SUSQUEHANNA AND POTOMAC RIVER BASINS.
Geological Survey, Harrisburg, PA. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-109959, Price codes: A15 in paper copy, A01 in microfiche.
Geological Survey Water-Data Report PA-81-2, 1982. 337 p, 9 Fig.

Descriptors: *Hydrologic data, *Surface water, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Wells, Water level, Data collections, Sites, *Pennsylvania, Susquehanna River basin, Potomac River basin.

Water resources data for the 1981 water year for Pennsylvania consist of records of discharge and water quality of streams, contents of lakes and reservoirs, and water levels of ground-water wells. This volume contains records for water discharge at 96 gaging stations, contents at 13 lakes and reservoirs, water quality at 39 gaging stations, and water levels at 26 observation wells. Also included are data for 19 crest-stage and 120 water-quality partial-record stations. Additional water data were collected at various sites not involved in the systematic data-collection program and are published as miscellaneous measurements and analysis. These data together with the data in Volumes 1 and 3 represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State, local and Federal agencies in Pennsylvania. (USGS)
W83-00998

WATER RESOURCES DATA, SOUTH DAKOTA, WATER YEAR 1981.
Geological Survey, Huron, SD. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-102715, Price codes: A16 in paper copy, A01 in microfiche.
Geological Survey Water-Data Report SD-81-1, 1982. 357 p, 7 Fig, 3 Tab.

Descriptors: *Hydrologic data, *Surface water, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Wells, Water level, Data collections, Sites, *South Dakota.

Water resources data for the 1981 water year for South Dakota consists of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels in wells. This report contains discharge records for 104 gaging stations, stage and contents for 10 lakes and reservoirs, water quality for 20 gaging stations, and water levels for 8 observation wells. Additional water data were collected at various sites, not part of the systematic data-collection program, and are published as miscellaneous measurements and analyses. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in South Dakota. (USGS)
W83-00999

WATER RESOURCES DATA, OHIO, WATER YEAR 1981--VOLUME 1. OHIO RIVER BASIN.
Geological Survey, Columbus, OH. Water Resources Div.
Geological Survey Water-Data Report OH-81-1, 1982. 502 p, 3 Fig.

Descriptors: *Hydrologic data, *Surface water, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Wells, Water level, Data collections, Sites, *Ohio, Ohio River basin.

Water resources data for the 1981 water year for Ohio consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels and water quality of ground-water wells. This report in two volumes contains records for water discharge at 169 gaging stations; stage and contents at 39 lakes and reservoirs; and water quality at 53 gaging stations and 59 wells; and water levels at 280 observation wells. Also included are data from 81 crest-stage partial-record stations, 120 low-flow partial-record stations, and 331 coal-hydrology synoptic sites. Additional water data were collected at various sites not involved in the systematic data-collection program and are published as miscellaneous measurements and analyses. These data represent that part of the National Water Data System collected by the U.S. Geological Survey and cooperating State, and Federal agencies in Ohio. (USGS)
W83-01000

WATER RESOURCES DATA, OHIO, WATER YEAR 1981--VOLUME 2. ST. LAWRENCE RIVER BASIN STATEWIDE PROJECT DATA.
Geological Survey, Columbus, OH. Water Resources Div.
Geological Survey Water-Data Report OH-81-2, 1981. 333 p, 3 Fig.

Descriptors: *Hydrologic data, *Surface water, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Wells, Water level, Data collections, Sites, *Ohio, St Lawrence River basin.

Water resources data for the 1981 water year for Ohio consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels

and water quality of ground-water wells. This report, in two volumes, contains records for water discharge at 169 gaging stations; stage and contents at 39 lakes and reservoirs; and water quality at 53 gaging stations and 59 wells; and water levels at 280 observation wells. Also included are data from 81 crest-stage partial-record stations, 120 low-flow partial-record stations, and 331 coal-hydrology synoptic sites. Additional water data were collected at various sites not involved in the systematic data-collection program and are published as miscellaneous measurements and analyses. These data represent that part of the National Water Data System collected by the U.S. Geological Survey and cooperating State, and Federal agencies in Ohio. (USGS)
W83-01001

WATER RESOURCES DATA, MONTANA, WATER YEAR 1981--VOLUME 2. COLUMBIA RIVER BASIN.
Geological Survey, Helena, MT. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-115964, Price codes: A09 in paper copy, A01 in microfiche. Geological Survey Water-Data Report MT-81-2, 1982. 174 p, 6 Fig, 6 Tab.

Descriptors: *Hydrologic data, *Surface water, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Wells, Water level, Data collections, Sites, *Montana, Columbia River basin.

Water resources data for the 1981 water year for Montana consist of records of stage, discharge, and water quality of streams; stage, contents and water quality of lakes and reservoirs; and water levels in wells. Volume 2 of this report contains discharge records for 48 gaging stations, stage and contents for 3 lakes and reservoirs, water quality for 18 stations and 3 lakes, and water levels for 14 observation wells. Also included are 30 crest-stage partial-record stations and 20 smaller reservoirs. Additional water data were collected at various sites, not part of the systematic data-collection program, and are published as miscellaneous measurements. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in Montana. (USGS)
W83-01002

WATER RESOURCES DATA, IDAHO, WATER YEAR 1981--VOLUME 1. GREAT BASIN AND SNAKE RIVER BASIN ABOVE KING HILL,
Geological Survey, Boise, ID. Water Resources Div.
Geological Survey Water-Data Report ID-81-1, 1982. 447 p, 12 Fig.

Descriptors: *Hydrologic data, *Surface water, *Groundwater, *Water quality, Gaging stations, Stream-flow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Wells, Water level, Data collections, Sites, *Idaho, Great Basin, Snake River basin.

Water resources data for the 1981 water year for Idaho consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels and water quality of ground-water. This report in two volumes contains discharge records for 204 gaging stations; stage only records for 2 gaging stations; stage only for 11 lakes and reservoirs; contents only for 16 lakes and reservoirs; water quality for 84 gaging stations, 77 partial-record stations, 138 wells, and 5 precipitation sites; and water levels for 469 observation wells. Also included are data for 38 crest-stage partial-record stations. Additional water data were collected at various sites, not involved in the systematic data-collection program, and are published as miscellaneous measurements. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in Idaho. (USGS)
W83-01003

WATER-QUALITY ASSESSMENT OF THE SMITH RIVER DRAINAGE BASIN, CALIFORNIA AND OREGON.
Geological Survey, Sacramento, CA. Water Resources Div.
R. T. Iwatsubo, and D. S. Washabaugh.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-224492, Price codes: A07 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 81-22, March 1982. 118 p, 32 Fig, 23 Tab, 52 Ref.

Descriptors: *Water quality, *Groundwater, *Surface water, *Hydrologic data, Water quality standards, Physical properties, Chemical properties, Biological properties, Water quality control, *California, *Oregon, Smith River, Del Norte County, Siskiyou County.

A water-quality assessment of the Smith River drainage basin was made to provide a summary of the water-quality conditions including known or potential water-quality problems. Results of the study showed that the water quality of the Smith River is excellent and generally meets the water-quality objectives for the beneficial uses identified by the California Regional Water Quality Control Board, North Coast Region. Known and potential problems related to water quality include: Sedimentation resulting from both natural erosional processes and land-use activities such as timber harvest, road construction, and mining that accelerate the erosional processes; bacterial contamination of surface and ground waters from inundated septic tanks and drainfields, and grazing activities; industrial spills which have resulted in fish kills and oil residues; high concetrations of iron in ground water; log and debris jams creating fish migration barriers; and pesticide and trace-element contamination from timber-harvest and mining activities, respectively. Future studies are needed to establish: (1) a sustained long-term monitoring program to provide a broad coverage of water-quality conditions in order to define long-term water-quality trends; and (2) interpretive studies to determine the source of known and potential water-quality problems. (USGS)
W83-01006

WATER RESOURCES PROGRAMS OF THE U.S. GEOLOGICAL SURVEY RELATED TO AGRICULTURE IN LOUISIANA,
Geological Survey, Baton Rouge, LA. Water Resources Div.
T. L. Huntzinger.
Available from OFSS, USGS Box 25425, Fed. Ctr. Denver, CO 80225. Paper copy $2.75, Microfiche $3.50. Geological Survey Open-File Report 82-554, May 1982. 19 p, 7 Fig, 1 Tab, 4 Ref.

Descriptors: *Agriculture, *Data collections, *Gaging stations, *Sites, Flood data, Crest gages, Groundwater, Water quality, Surface water, Water quality, Wells, Water level, Low flow, Water supply, *Louisiana.

Surveillance activities of the U.S. Geological Survey Louisiana District include long-term, hydrologic-data-collection sites that serve a current-purpose, management function and (or) that furnish a data base for interpretative studies. The proposed program for 1982 includes a network of 69 surface-water data sites (continuous gaging stations), 250 flood-data sites (crest-stage stations), 679 ground-water wells (water-level observation and water-quality monitor wells), and 138 water-quality sites. The geographic distribution of the data sites is shown in the report. Interpretive studies have objectives that are oriented toward a particular geographic area, to a particular set of hydrologic phenomena, or to obtain information for use in solving specific problems. Current studies of interest to agriculture include the following: (1) Flood hydraulics and hydrology, (2) Low-flow or base-flow of streams in Louisiana, (3) Hydrologic studies in southwestern Louisiana, (4) Hydrologic impacts of surface mining in northern Louisiana, (5) Sparta aquifer study, and (6) Limnology of freshwater lakes. A network of partial record sites is also maintained to monitor specific flows. Peak stages (crest stage) are only recorded at sites where flood information is of interest. At other sites, only the low-flow or base-flow recession is obtained for use in determining relations between ground water and surface water, to assess water supply, and for effluent studies. (USGS)
W83-01007

U.S. GEOLOGICAL SURVEY ACTIVITIES, FISCAL YEAR 1981.
Geological Survey, Reston, VA. Water Resources Div.
Available from USGS, Text Pdts. Sect. 604 S. Pickett St. Alexandria, VA 22304. Geological Survey Circular 875, 1982. 161 p.

Descriptors: *Reviews, *Data collections, *Natural resources, Water quality, Energy, Mapping, Geological surveys, Volcanoes, Landslides, Mineralogy, Land management, Oil industry, Administration, Cost allocation, Budgeting, *US Geological Survey.

This U.S. Geological Survey Activities report for fiscal year 1981 presents a summary of the work performed between October 1, 1980 and September 30, 1981. The main sections of this report are: (1) The Year in Review; a brief overview of the significant events of the Geological Survey during fiscal year 1980; (2) Perspectives; essays focusing on specific events (rather than scientific topics) and programs involving multi-Division participation; (3) Missions, Organization, and Budget; a description of the Geological Survey's major duties and assignments and of the organizational structure that supports its missions; and (4) Division Chapters; a description of the significant accomplishments (rather than a comprehensive program by program discussion) of each of the eight operating Divisions and Offices. Also included are supplementary information regarding key personnel, cooperators, and selected summary budgetary tables. (USGS)
W83-01009

GEOLOGICAL SURVEY RESEARCH 1981.
Geological Survey, Reston, VA. Water Resources Div.
Available from Supt. of Documents, GPO, Washington, DC 20402, Price $9.50. Geological Survey Professional Paper 1275, 1982. 402 p, 1 Fig, 5 Tab, 284 Ref.

Descriptors: *Natural resources, Mineralogy, Water analysis, Land use, Mapping, Data collections, Chemical analysis, Geothermal studies, Oil, Coals, Remote sensing, Evaluation, *U.S. Geological Survey projects, *United States, Foreign countries.

This U.S. Geological Survey activities report includes a summary of 1981 fiscal year scientific and economic results accompanied by a list of geologic, hydrologic, and cartographic investigations in progress. The summary of results includes: (1) Mineral, (2) Water resources, (3) Engineering geology and hydrology, (4) Regional geology, (5) Principles and processes, (6) Laboratory and field methods, (7) Topographic surveys and mapping, (8) Management of resources on public lands, (9) Land information and analysis, and (10) Investigations in other countries. Also included are lists of investigations in progress. (USGS)
W83-01010

8. ENGINEERING WORKS

8A. Structures

CHUTE SPILLWAY DESIGN CALCULATIONS,
University of Strathclyde, Glasgow (Scotland).
J. Ellis, and G. Pender.
Proceedings of the Institution of Civil Engineers. Part 2: Research and Theory, Vol 73, No 2, p 299-312, June, 1982. 8 Fig, 8 Ref.

Descriptors: *Design criteria, *Flow, *Waves, *Flood discharge, *Chutes, *Spillway gate, Design floods, Design standards, Oveflow channels, Spillway capacity, Spillways, Velocity, Mathematical studies, Supercritical flow, Dams, Physical properties.

The initial stages of development of a numerical model are described. The model enables prediction of water depth and wall height to be made throughout the length of a spillway chute, including the complex wave region. Spillway chute dimensions are an important aspect of reservoir design; calculations are complicated by the presence of rapid flow, oblique waves, and complex wave interactions occurring downstream. Modelling of nearly horizontal flow in two dimensions was based on the theory of characteristics. During the model's development flexibility of application, ease of use and economy of calculation were emphasized. Many aspects of spillway chute flow behavior were omitted from the model for the initial study. Vertical velocity, acceleration, and tranquil flow solutions were among the omitted aspects which should be included in future, refined versions of the model. (Titus-FRC)
W83-00765

HYDRAULIC MODEL STUDY OF CHOKE CANYON DAM SPILLWAY AND STILLING BASIN,
Bureau of Reclamation, Denver, CO. Engineering and Research Center.
R. L. George.
Report GR-82-9, August 1982. 35 p, 25 Fig, 3 Ref.

Descriptors: *Spillways, *Stilling basins, *Dam design, *Hydraulic models, Model studies, Flow, Scour, Froude number, *Texas, Frio River, Choke Canyon Dam.

The Choke Canyon damsite is located on the Frio River in south central Texas. The main purpose of the dam is to provide municipal and industrial water to Corpus Christi and adjoining areas. The reservoir also will provide some flood control and recreational benefits. A 1:80 scale hydraulic model of the Choke Canyon Dam spillway and stilling basin was studied to verify stilling basin design, flow conditions, and scour in the spillway approach channel. The dam will be 35 m high and have a crest length of 5640 m. The spillway chute is 112.2 wide and has a Froude number of about 4.4 at the stilling basin entrance. The stilling basin was designed to criteria developed for low Froude number flows. A modified entrance channel was developed as the model was tested. Stilling basin walls were shortened as a result of the model studies. The design recommemded for Choke Canyon Dam has a concrete apron 14 m long, downstream from the end of the stilling basin, followed by a 32-m long section of riprap. The design worked well for all discharges, and scour was limited to an area downstream from the riprap. (Moore-SRC)
W83-00918

HYDRAULIC MODEL STUDY OF UTE DAM LABYRINTH SPILLWAY,
Bureau of Reclamation, Denver, CO. Engineering and Research Center.
For primary bibliographic entry see Field 8B.
W83-00920

REPORT ON ASSESSMENT OF LOW-HEAD HYDROELECTRIC SITES IN THE WESTERN STATES; METHOLOGY AND SUMMARY.
Tudor Engineering Co., Denver, CO.
For primary bibliographic entry see Field 6C.
W83-00922

APPENDIX TO REPORT ON ASSESSMENT OF LOW-HEAD HYDROELECTRIC SITES IN THE WESTERN STATES; EVALUATION REPORTS FOR LOW-HEAD HYDROELECTRIC SITES, PART I - CALIFORNIA.
Tudor Engineering Co., Denver, CO.
Bureau of Reclamation Report, March 1982, 106 p, 31 Fig, 33 Tab.

Descriptors: *Hydroelectric plants, *Low head, *Cost analysis, *Feasibility studies, *California, Site selection, Environmental effects, Social impacts, Dam design.

The site reports contained in this appendix are part of the Phase III Study conducted as part of the Low-Head Hydroelectric Evaluation and Inventory. The 9 site reports for California include the following power projects: Goodyears Bar, Mill Creek, D'Amico Dam, Hamster Dam, Lamoine, Bethstein dam, Big Bar, Ditch Camp, and Esmerelda. Field reconnaissance investigations were conducted to determine topography, geology, and other site specific information, as well as to gather information pertaining to potential social and environmental impacts which could result from development of the project. Based on the field data, site specific preliminary designs and cost estimates were developed according to the Bureau of Reclamation's standards for appraisal level design. Appraisal designs are defined as those having sufficient detail to give an initial indication of the project's feasibility. These designs normally are used to formulate a decision to proceed with a more detailed feasibility study. Analyses of the benefits and costs for the specific site were performed to measure the economic feasibility. These site reports contain a project description, a preliminary evaluation of the potential social and environmental impacts that could result from development of the project, a summary and details of the powerplant economic sizing studies, and a project plan layout. (Moore-SRC)
W83-00923

APPENDIX TO REPORT ON ASSESSMENT OF LOW-HEAD HYDROELECTRIC SITES IN THE WESTERN STATE; EVALUATION REPORTS FOR LOW-HEAD HYDROELECTRIC SITES, PART II - COLORADO.
Tudor Engineering Co., Denver, CO.
Bureau of Reclamation Report, March 1982. 156 p, 56 Fig, 42 Tab.

Descriptors: *Hydroelectric plants, *Low head, *Cost analysis, *Feasibility studies, *Colorado, Site selection, Environmental effects, Social impacts, Dam design.

The site reports contained in this appendix are part of the Phase III Study conducted as part of the Low-Head Hydroelectric Evaluation and Inventory. The 14 site reports for Colorado include the following power projects: Mount Harris, Gore Canyon, Canyon, Radium, Glenwood Canyon, Storm King, South Canyon, Garfield, Grand Valley, DeBeque, Sheephorn, Americus, Elephant Rock, and Pagosa Junction. Field reconnaissance investigations were conducted to determine topography, geology, and other site specific information, as well as to gather information pertaining to potential social and environmental impacts which could result from development of the project. Based on the field data, site specific preliminary designs and cost estimates were developed according to the Bureau of Reclamation's standards for appraisal level design. Appraisal designs are defined as those having sufficient detail to give an initial indication of the project's feasibility. These designs normally are used to formaulate a decision to proceed with a more detailed feasibility study. Analyses of the benefits and costs for the specific site were performed to measure the economic feasibility. These site reports contain a project description, a preliminary evaluation of the potential social and environmental impacts that could result from development of the project, a summary and details of the powerplant economic sizing studies, and a project plan layout. (Moore-SRC)
W83-00924

APPENDIX TO REPORT ON ASSESSMENT OF LOW-HEAD HYDROELECTRIC SITES IN THE WESTERN STATES; EVALUATION REPORTS FOR LOW-HEAD HYDROELECTRIC SITES, PART III - IDAHO AND UTAH.
Tudor Engineering Co., Denver, CO.
Bureau of Reclamation Report, March 1982. 172 p, 60 Fig, 45 Tab.

Descriptors: *Hydroelectric plants, *Low head, *Cost analysis, *Feasibility studies, *Idaho, *Utah, Site selection, Environmental effects, Social impacts, Dam design.

The site reports contained in this appendix are part of the Phase III Study conducted as part of the Low-Head Hydroelectric Evaluation and Inventory. The 9 site reports for Idaho include the following power projects: Kanaka Rapids, Auger Falls, Porter Creek, Gardena, Dry Buck, Tripod Peak, Alpha, Caribou, and Lufkin Bottom. The power project sites for Utah include: Sand Knolls, Mat Martin, Dead Horse, Horsethief, Ninemile, and Slickhorn. Field reconnaissance investigations were conducted to determine topography, geology, and other site specific information, as well as to gather information pertaining to potential social and environmental impacts which could result from development of the project. Base on the field data, site specific preliminary designs and cost estimates were developed according to the Bureau of Reclamation's standards for appraisal level design. Appraisal designs are defined as those having sufficient detail to give an initial introduction of the project's feasibility. These designs normally are used to formulate a decision to proceed with a more detailed feasibility study. Analyses of the benefits and costs for the specific site were performed to measure the economic feasibility. These site reports contain a project description, a preliminary evaluation of the potential social and environmental impacts that could result from development of the project, a summary and details of the powerplant economic sizing studies, and a project plan layout. (Moore-SRC)
W83-00925

APPENDIX TO REPORT OF ASSESSMENT OF LOW-HEAD HYDROELECTRIC SITES IN THE WESTERN STATES; EVALUATION REPORTS FOR LOW-HEAD HYDROELECTRIC SITES, PART IV - KANSAS, NEW MEXICO, OKLAHOMA, AND TEXAS.
Tudor Engineering Co., Denver, CO.
Bureau of Reclamation Report, March 1982. 191 p, 68 Fig, 51 Tab. 0-07-DV-00031.

Descriptors: *Hydroelectric plants, *Low head, *Cost analysis, *Feasibility studies, *Kansas, *New Mexico, *Oklahoma, *Texas, Site selection, Environmental effects, Social impacts, Dam design.

The site reports contained in this appendix are part of the Phase III Study conducted as part of the Low-Head Hydroelectric Evaluation and Inventory. The site reports include the following power projects: in Kansas - Edwardsville, Lecomption, and Tecumsah Dam; in New Mexico - Archuleta, Cudai, Red Wash, and Mancos River; in Oklahoma - Lone Elm, Oolagah, Fairfax, and Spiro; in Texas - Threemile Creek, Indian Lake, Garrett's Bluff, Valliant Reservoir, Wade Reservoir, and Democrat Crossing. These site reports show the results of a more detailed technical analysis of selected sites. Field reconnaissance investigations were conducted to determine topography, geology, and other site specific information, as well as to gather information pertaining to potential social and environmental impacts which could result from development of the project. Based on the field data, site specific preliminary designs and cost estimates were developed according to the Bureau of Reclamation's standards for appraisal level design. Appraisal designs are defined as those having sufficient detail to give an initial indication of the project's feasibility. These designs normally are used to formulate a decision to proceed with a more detailed feasibility study. Analyses of the benefits and costs for the specific site were performed to measure the economic feasiblity. These site reports contain a project description, a preliminary evaluation of the potential social and environmental impacts that could result from development of the project, a summary and details of the powerplant economic sizing studies, and a project plan layout. (Moore-SRC)
W83-00926

APPENDIX TO REPORT ON ASSESSMENT OF LOW-HEAD HYDROELECTRIC SITES IN

THE WESTERN STATES; EVALUATION REPORTS FOR LOW-HEAD HYDROELECTRIC SITES, PART V - MONTANA AND WYOMING.
Tudor Engineering Co., Denver, CO.
Bureau of Reclamation Report, March 1982. 166 p, 60 Fig, 45 Tab. 0-07-DV-00031.

Descriptors: *Hydroelectric plants, *Low head, *Cost analysis, *Feasibility studies, *Montana, *Wyoming, Site selection, Environmental effects, Social impacts, Dam design.

The site reports contained in this appendix are part of the Phase III Study conducted as part of the Low-Head Hydroelectric Evaluation and Inventory. The 12 site reports for Montana include the following power projects: Lower Thompson Falls, Tepee, Lombard, Sentinel, Little Porcupine, Ulm, Alberton, Swan Lake, Weeksville, Seven Mile Rapids, Cold Creek, and Superior. Wyoming site reports include Cody Power Project, Trotters Station Power Project, and Iron Creek Power Project. These site reports who the results of a more detailed technical analysis of selected sites. Field reconnaissance investigations were conducted to determine topography, geology, and other site specific information, as well as to gather information pertaining to potential social and environmental impacts which could result from development of the project. Based on the field data, site specific preliminary designs and cost estimates were developed according to the Bureau of Reclamation's standards for appraisal level design. Appraisal designs are defined as those having sufficient detail to give an initial indication of the project's feasibility. These designs normally are used to formulate a decision to proceed with a more detailed feasibility study. Analyses of the benefits and costs for the specific site were performed to measure the economic feasibility. These site reports contain a project description, a preliminary evaluation of the potential social and environmental impacts that could result from development of the project, a summary and details of the powerplant economic sizing studies, and a project plan layout. (Moore-SRC)
W83-00927

APPENDIX TO REPORT ON ASSESSMENT OF LOW-HEAD HYDROELECTRIC SITES IN THE WESTERN STATES; EVALUATION REPORTS FOR LOW-HEAD HYDROELECTRIC SITES, PART VI - OREGON AND WASHINGTON.
Tudor Engineering Co., Denver, CO.
Bureau of Reclamation Report, March 1982. 177 p, 64 Fig, 48 Tab.

Descriptors: *Hydroelectric plants, *Low head, *Cost analysis, *Feasibility studies, *Oregon, *Washington, Site selection, Environmental effects, Social impacts, Dam design.

The site reports contained in this appendix are part of the Phase III Study conducted for Reclamation (Bureau of Reclamation) by Tudor Engineering Company as part of the Low-Head Hydroelectric Evaluation and Inventory. The 8 site reports for Oregon include the following power projects: Lower Opal City, Upper Opal City, Lower Smock Prairie, Upper Smock Prairie, New Bull Run, Hamner Creek, Chalk Creek, and Black Canyon. For Washington, site reports are provided for the following 8 power projects: Pinnacle peak, Mud Mountain No 2, New Husum, Brush Creek, New Robe, Warnick, McLaughlin Falls and Oroville. These site reports show the results of a more detailed technical analysis of selected sites. Field reconnaissance investigations were conducted to determine topography, geology, and other site specific information, as well as to gather information pertaining to potential social and environmental impacts which could result from development of the project. Based on the field data, site specific preliminary designs and cost estimates were developed according to the Bureau of Reclamation's standards for appraisal level design. Appraisal designs are defined as those having sufficient detail to give a initial indication of the project's feasbility. These designs normally are used to formulate a decision to proceed with a more detailed feasibility study. Analyses of the benefits and costs for the specific site were performed to measure the economic feasibility. These site reports contain a project description, a preliminary evaluation of the potential social and environmental impacts that could result from development of the project, a summary and details of the powerplant economic sizing studies, and a project plan layout. (Moore-SRC)
W83-00928

CONSTRUCTION, OPERATION AND MAINTENANCE OF GRAVEL WELLS,
Chapman (R. H.) Co., Oakdale, MA.
R. W. Sullivan.
Journal of the New England Water Works Association, Vol 96, No 1, p 12-24, 1982. 5 Fig, 1 Tab.

Descriptors: *Well design, *Gravel, *Design criteria, Well screens, Safe yield, Maintenance, Well data.

Exploratory drilling and geological and hydrological data were used to design a gravel well 80 ft deep in sand. An 8 inch test well and several 2.5 inch observation wells, 2 to 400 ft from the 8 inch well, were driven. Clean coarse sand was found at 50-80 ft. Stabilization was reached at 500 gpm pumping rate. Specific yields measured in the 8 inch well and an observation well were 15 and 35 gpm per ft of drawdown, respectively. The following design criteria were developed from this data: depth, 80 ft; diameter, 48 x 24 inches; well screen, 15 ft of 24 inch stainless steel with a slot opening of 0.120 inches; 2 envelopes of Cape May gravel 1.25 x 1/8 inch next to the screen and 14 mesh in the outer envelope and separated with a 36 inch guided pipe; pump rate 1200 gpm; entrance velocity, 0.1 ft per sec. The well will be developed after pulling up the 48 inch x 36 inch piped to form a bond between gravel and aquifer sands. This technique prevents disturbance of sand grains. The 36 inch pipe will be returned to the 20 ft level. The well should show specific yield of 30 gpm per ft of drawdown. (Cassar-FRC)
W83-00966

KIELDER WATER (UK) PROJECT HAS ROYAL OPENING.
Aqua, No 5, p 37-40, 1982. 2 Fig.

Descriptors: *Reservoirs, *Construction, *Water resources development, Water supply, Earth dams, Dams, Lakes, Man-made lakes, Kielder Water, Pipelines, Rivers, Water demand, *United Kingdom.

The largest water resource project in the United Kingdom, at Kielder in the North Tyne Valley in Northumberland, was opened in May of 1982. This project ensures water supplies across the northeast of England until well into the next century, and creates a regional water grid for the first time in Britain. Water is collected in Northern Europe's largest man-made lake just below the high rainfall Pennine ridge and transferred via three major rivers and a pipeline and tunnel system to make it available to the populous industrial areas on the river estuaries. The new lake will also be an unrivalled new water recreation area. Kielder Water has a surface area of 2,684 acres. It can store 44 billion gallons of water. An earth dam three quarters of a mile long and 170 feet high was built, taking five summer seasons to complete. Buried in the dam are more than 700 recording instruments that provide information on the state of the structure and relay it to instrument houses at the north and south ends. (Baker-FRC)
W83-01033

CONTINUOUS WITHDRAWAL FROM SELECTED RESERVOIR STRATA.
Journal of the American Water Works Association, Vol 74, No 9, p 36-37, September, 1982. 1 Fig.

Descriptors: *Intakes, *Reservoir releases, *Flow augmentation, Fish barriers, Delaware River, Merrill Creek, *New Jersey, Flow control.

The planned Merrill Creek reservoir project in New Jersey will feature a discharge control device to withdraw warm oxygenated surface water for flow augmentation of the Delaware River, a warm water fishery. The proposed design is a sloping, reinforced concrete box enclosing a collection pipe with valved ports vertically spaced every 3.8 m. A control building is at the top of the shaft. To prevent deeper reservoir water from being discharged as the water surface lowers, a rail-mounted hood with fish screen intake will direct water from the surface to the submerged outlet ports. For other applications this device could be designed to travel vertically to control outlets in a dam face or tower so that water could be withdrawn at any level. (Cassar-FRC)
W83-01043

8B. Hydraulics

THE DESIGN OF LOOPED WATER DISTRIBUTION NETWORKS BY APPLICATION OF LINEAR PROGRAMMING (DIE DIMENSIONIERUNG VON VERMASCHTEN WASSERVERTEILUNGSNETZEN UNTER ANWENDUNG DER LINEAREN PROGRAMMIERUNG),
Asian Inst. of Tech., Bangkok (Thailand). Div. of Environmental Engineering.
H. Orth.
Gas-Wasserfach Wasser-Abwasser, Vol 123, No 5, p 235-239, May, 1982. 2 Fig, 4 Ref.

Descriptors: *Water distribution, *Design criteria, *Mathematical models, *Cost analysis, *Network design, Mathematical equations, Pipes, Pipe diameters, Water conveyance, Flow characteristics, Hydraulics, Hydraulic Design, Water pressure, Head loss.

The formal mathematical problems of a linear optimization program for minimizing costs for looped water distribution systems are presented, together with some principles of minimum-cost network design and comparisons with traditional design methods. Calculation of pipe diameters with the aid of the linear optimization program is described; this follows from a given flow distribution within the network, and thus differs from the Hardy-Cross procedure in which flow distribution is a result of the diameter calculation. The optimization program consists of a linear system of four equations to describe hydraulic conditions within the network. The system usually yields several solutions, and a fifth equation allows the calculation of the least expensive of these. The relationship between pressure loss and costs of a strand of the network is described, as are the choice of acceptable diameter of a strand in relation to the solubility of the system and strategies for the determination of flow distribution. The conceptual difference between this and the Hardy-Cross procedure is that the latter provides hydraulic calculation for an already-existing network, while the former is a design procedure. Reduction of cost is achieved by using smaller diameters and less pressure. Diameter changes even between intersections in the network were shown by the optimization program to be cost-effective, though in practice these are not always workable. If the equation system proves insoluble, the calculation of two subsidiary equations will reveal which parts of the network or which assumptions are causing this so that they can be modified. (Gish-FRC)
W83-00772

HYDRAULIC MODEL STUDY OF UTE DAM LABYRINTH SPILLWAY,
Bureau of Reclamation, Denver, CO. Engineering and Research Center.
K. L. Houston.
Report GR-82-7, August 1982. 47 p, 30 Fig, 2 Tab, 4 Ref, 1 Append.

Descriptors: *Spillways, *Model studies, *Labyrinth spillways, *Hydraulic design, Hydraulic models, Design floods, Storage capacity, Nappe, Flow magnification, Slope protection, Impact pressures, Subatmospheric pressures, Splinter piers, *New Mexico, *Weirs, Ute Dam.

Ute Dam, located on the Canadian River 3.2 km west of Logan, New Mexico, is a 36.88-m high

embankment dam with a gated outlet works and a 256.03-m wide free overflow spillway. The original spillway design included 8.23-m high gates which were not installed. Without the gates to increase the reservoir storage capacity, the requirements of future water users could not be met. An economical labryrinh spillway, was selected to increase the storage capacity of the reservoir because a longer length is provided for a given channel width. In plan, the spillway is a series of trapezoidal shapes. The Ute Dam spillway will be 9.14 m high and 1024.13 m in length, with 14 cycles. This spillway will provide the desired storage capacity and still pass the IDF (inflow design flood). The spillway is designed for 5.79 m of head which produces a flow magnification of 2.4. Impact pressures taken in the downstream channel will be used in the stability design of the spillway. At low discharges, subatmospheric pressures develop under the nappe near the top of the crest. Two splitter piers on each cycle alleviate these pressures. Velocities measured along the embankment provide information on slope protection required adjacent to the labyrinth. (Moore-SRC)
W83-00920

COLUMBIA RIVER ENTRANCE CHANNEL SHIP MOTION STUDY,
Rosentiel School of Marine and Atmospheric Science, Miami, FL.
S. Wang, and S. Noble.
Journal of the Waterway Port Coastal and Ocean Division, Proceedings of the American Society of Civil Engineers, Vol 108, No WW3, p 291-305, August, 1982. 10 Fig, 2 Tab, 15 Ref.

Descriptors: *Model studies, *Rivers, *Channel improvement, *Navigation, Water resources development, Design criteria, Channels, Navigation canals, *Columbia River.

Through measurements and analysis of prototype vessel motions, the need for a deeper channel was determined, design information for potential modification to the Columbia River proect was provided, and information was gained which could be used to evaluate present dredging operations. A portable measuring system with instrumentation to record pitch, roll, heave, heading and vessel positions was specifically developed for the purposes of this study. Statistical analyses of the measured data in terms of both short and long term distributions of the vessel motions were conducted. The findings of the study suggest that a deeper entrance channel will improve the movement of the existing vessel fleet and will be required for the consistent movement of larger vessels. Data also indicate that the magnitude of vertical motion is a function of position along the channel axis. Horizontal motion data suggests that a channel narrower than the present 2,640 ft width is a viable option. Thus there are three basic alternatives being considered: a deeper channel along the entire channel length, a deeper channel for a portion of the project, or a narrower channel. Each alternative is being considered through the development of models. (Baker-FRC)
W83-00935

UNSTEADY FLOW STUDIES IN CHINA,
Colorado State Univ., Fort Collins.
P. N. Lin, Z. Dai, and K. Li.
Journal of the Waterway Port Coastal and Ocean Division, Proceedings of the American Society of Civil Engineers, Vol 103, No WW3, p 343-360, August, 1982. 9 Fig, 1 Tab, 21 Ref.

Descriptors: Flow, *Estuaries, *Sediments, *Mathematical equations, Sediment transport, Suspended load, Reviews, *China, Tidal hydraulics, *Salinity, Suspended sediment, Channels, Bathymetry, Dams, Waves, Hydrographs, *Unsteady flow.

Results of research into unsteady flow problems encountered in China are reported. A variety of problems is considered, including one- and two-dimensional tidal flow in estuaries, dam-break waves, routing of suspended load, and prediction of salinity. Stability and accuracy has been achieved in the study of one and two dimensional problems of tidal flow as well as one-dimensional routing of salinity and suspended sediment in a channel with bore by the use of the characteristic oriented scheme proposed by Zhang. A way of evaluating various troublesome terms, providing a wise choice of variables and thus facilitating the schematization of the bathymetry was found through the method of virtual characteristics as developed by Jin, Shi, and others. Special conditions on the study of dam-break waves are encountered in China due in part to the multitude of dams present in the country. A solution for the dam-site hydrographs due to sudden release of storage from a prismatic reservoir of finite length is available and was found to agree well with flume test data. In the routing of sediment a small concentration approximation has been proposed to decouple the fundamental equations of motion for water and sediment. Transport of suspended sediment through an estuary has been simulated over 42 tides. A dispersion coefficient for salinity has been found which proves accurate for theee estuary of Qiantang and has been used successfully in controlling the salinity of water supply to the region along the estuary. (Baker-FRC)
W83-00936

HYDROMECHANICS OF TIDAL JETS,
Tetra Tech, Inc., Jacksonville, FL.
For primary bibliographic entry see Field 2L.
W83-00938

STEADY FLOW IN ALLUVIAL CHANNELS,
For primary bibliographic entry see Field 2E.
W83-00940

MOVABLE-BED TIDAL INLET MODEL,
Iowa Univ., Iowa City. Inst. of Hydrological Research.
For primary bibliographic entry see Field 2L.
W83-00941

NONLINEAR DIFFRACTION BY EIGENFUNCTION EXPANSIONS,
SONAT Offshore Drilling, Inc., Houston, TX.
M. C. Chen, and R. T. Hudspeth.
Journal of the Waterway Port Coastal and Ocean Division, Proceedings of the American Society of Civil Engineers, Vol 108, No WW3, p 306-325, August, 1982. 4 Fig, 3 Tab, 23 Ref.

Descriptors: *Mathematical equations, *Waves, *Water depth, Hydrodynamics, Fluid mechanics, Flow characteristics.

A nonlinear diffraction theory correct to second-order is presented which is based on an eigenfunction expansion of Green's function for a fixed axisymmetric body subjected to a two-dimensional sinusoidal incident wave. The theoretical numerical results obtained indicate that second-order contributions to the hydrodynamic forces are significant in an intermediate water depth region and may become more important in the shallow water depth region. This implies that as vertical cylindrical structures are subjected to inertia dominated hydrodynamic forces in water of finite depth, the second-order nonlinear effects should be taken into consideration. (Baker-FRC)
W83-00942

DESIGN AND CONSTRUCTION OF FLEXIBLE GROYNES (ENTWURF UND BAU FLEXIBLER BUHNEN),
Stuttgart Univ. (Germany, F. R.). Inst. fue Wasserbau.
J. Giesecke, E. Hafner, F. Otto, and A. Timon.
Wasserwirtschaft, Vol 71, No 12, p 357-363, December, 1981. 11 Fig, 5 Ref. English summary.

Descriptors: *Groins, *Flow control, *River training, *Hydrualic engineering, *Federal Republic of Germany, Rhine River, Model studies, Design criteria, Prototype tests, Flexible groins, Water level, Erosions control, Rivers.

Design criteria, model studies, and pilot tests for the newly developed flexible groin for the regulation of river flow are described. The groin was developed by Stuttgart University when conventional methods failed to prevent changes in flow speed and river-bed erosion in certain sections of the Rhine. The aim of the groin is to raise the level of the river at low water without causing an increased current speed near the groin due to reduced river-bed width, which would lead to erosion. The groin is an object made of watertight fabric that can be inflated and deflated. It is inflated at low water to reduce river cross-section and dam flow and deflated at high water so as not to block the channel. Two- and three-dimensional hydraulic models showed that the two-chambered groin would be most successful for economic, technical, and hydraulic reasons. This groin consists of two wedge-shaped chambers lying on top of one another with the this end of the wedge pointing upstream. It is anchored to the river bed and can be inflated and deflated from the bank. Three prototype groins were placed in the Rhine near Duisburg on the inner side of a bend in the river. After 8 months they were removed and inspected. The groins were successful in controlling river flow, as has been predicted by the model studies. Faults in construction were mainly due to construction techniques and materials, particularly in the area of membrane material and bonding. The neoprene coating had come apart from the fabric in large pieces. A great deal of damage to the clamping plate bonding occurred. Metal parts were corroded. Operation was hindered by the weather. No suitable material for the construction of these groins has yet been invented, so the field remains open to industry. Further studies in nature, investigations into the optimal groin shape and operational improvement, and specal material tests are being performed. (Gish-FRC)
W83-00974

8D. Soil Mechanics

FROST ACTION IN SOIL FOUNDATIONS AND CONTROL OF SURFACE STRUCTURE HEAVING,
Bureau of Reclamation, Denver, CO. Engineering and Research Center.
C. W. Jones, D. G. Miedema, and J. S. Watkins.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-118299, Price codes: A05 in paper copy, A01 in microfiche. Report REC-ERC-82-17, June 1982. 75 p, 42 Fig, 33 Ref, 3 Apénd.

Descriptors: *Frost heaving, *Soil foundations, *Soil mechanics, *Hydraulic structures, Freezing, Insulation, Soilwater, Thawing, Earth dams, Spillways, Chutes, Pipes, Check structures, Canal linings.

A Bureau of Reclamation survey showed that seasonal frost action in soil foundations was a consideration in all regions except the Mid-Pacific, Lower Colorado, and Southwest Regions, and was of most concern in the Upper Missouri Region. Significant frost heave in soils occurs in cold climates when certain fine-grained soils have access to sources of water and an open-freezing system exists. Under hetergeneous soil and moisture conditions, damage to structures is caused by differential movement during periods of freezing and thawing. The conventional methods of controlling frost action are: location of the foundation below the frost penetration level; replacement of frost susceptible soil with soil that this not affected by frost; restriction of the supply of water to the frost zone; and the use of insulation to reduce the depth of frost penetration. Bureau hydraulic structures which have suffered the most damage from frost action include: spillways; chutes and drip structures; checks, pipe turnouts, pier-supported pipe, and canal linings. Frost action is also a consideration in soil canal linings and in earth enbankment dams constructed in cold climates. A promising new technique to control frost heave is the use of polystyrene insulation. Field experiments with this insulation were conducted on the Riverton Unit, and the Pick-Sloan Missouri River Basin Program; it has also been used for small installations where special frost protection was required. (Moore-SRC)
W83-00919

CONTROL OF PORE WATER PRESSURES AT THE ZERVREILA ARCH DAM (MESSEN VON PORENWASSERDRUCK IM UNTERGRUND DER BOGENSTAUMAUER ZERVREILA),
Motor-Columbus Ingenieurunternehmung A.G., (Switzerland).
N. J. Schnitter.
Wasser, Energie, Luft, Vol 73, No 4, p 75-77, April 1981. 3 Fig. English summary.

Descriptors: *Pore pressure, *Arch dams, *Bedrock, *Uplift pressure, Dams, Zervreila dam, *Switzerland, Geologic formations, Deformation, Water pressure, Falling stage, Rising stage, Grouting, Geologic fractures, Hydraulic engineering, Crystalline rocks, Dam stability.

Investigations of pore water pressure in the bedrock under the Zervreila arch dam in Switzerland revealed that the valley sides downstream of the dam, integral to its suitability, were practically free of uplift. The Zervreila was built between 1953 and 9157 and has a maximum height of 151 m and a crown length of 504 m. The bedrock consists of crystalline gneiss that is tilted down from the right to the left valley side at an angle of about 20 degrees. This has resulted in extensive fissuring and surface loosening of the rock layers on the right bank, while the rock on the left bank is very compact. Correspondingly, there is minimal uplift on the left bank, whereas the dam was sunk at least 10 m into the rock on the right flank. Grouting was also more extensive on the right. Ggeosismic studies showed 40% (upper) to 60% (lower) deeper elasticity moduli on the right side. the state of the technology at the time of construction did not allow this to be taken into account so that significant dragging occurred in the direction of the length of the dam. Consequently one of the vertical contraction seams on the left flank opens during the falling stage, exactly above the point at which the foundation follows all too closely a bump in the inclination of the valley side. The annual opening of the seam was investigated by measuring uplift in the bedrock using three piezometer bores. The pore water pressures thus obtained were expressed as a percentage of the reservoir level above the measuring point. This figure remained constant over the greater portion of the rising and falling stages. At the seven points directly on the air side of the vertical grout curtain, 30-60% (average 45%) of reservoir level measured, which demonstrates a satisfactory functioning of the 20-year-old curtain. At the eight points under and on the airside of the foot of the dam only 0-25% (average 10%) of reservoir level was measured, indicating that the downstream rock abutments were almost uplift-free. Uplift was somewhat less on the right side due to the fact that two probe tunnels were acting to drain this area. (Gish-FRC)
W83-00973

8E. Rock Mechanics and Geology

LABORATORY MEASUREMENTS OF RESERVOIR ROCK FROM THE GEYSERS GEOTHERMAL FIELD, CALIFORNIA,
Geological Survey, Menlo Park, CA.
D. A. Lockner, R. Summers, D. Moore, and J. D. Byerlee.
International Journal of Rock Mechanics and Mining Sciences and Geomechanics Abstracts, Vol 19, No 2, p 65-80, 1982. 14 Fig, 2 Tab, 20 Ref.

Descriptors: *Geothermal studies, *Injection, *Stress, Rock mechanics, Geysers Geothermal Field, *California, Earthquakes, Pore pressure, Temperature effects, Shear stress, Friction, Steam.

Rock samples from the Geysers geothermal field, California, were tested at temperatures and pressures similar to those found in the geothermal field. Samples were taken from two outcrops and several cores from depths of 98-1478 m. Both intact and 30 degree sawcut cylinders were deformed at confining pressures of 200-1000 bars, pore pressure of 30 bars, and temperatures of 150 and 240C. Extensive alteration and crystallization of the rock was revealed by thin section and X-ray analysis. The coefficient of friction obtained by constant strain rate tests of 0.0001 and 0.000001 per sec was 0.68. This and the tectonics activity in the region suggest that shear stresses are very near the frictional strength. Since rock permeability is low, the large volume of extractable steam must be moving within a network of conduits. The presence of a cap rock, which prevents replenishment by meteoric water, suggests that artificial recharge is desirable to protect the resource. The b-values computed from acoustic emissions were about 0.55 during fluid injection and 1.3 during sudden injection of water. These values indicate that changes in temperature or pore pressure could trigger earthquakes of unknown consequence. (Cassar-FRC)
W83-00770

8G. Materials

HOW INHIBITORS IMPROVE ECONOMICS OF SCALE,
J. R. Smith.
World Water, Vol 5, No 7, p 55-56, 59, July, 1982.

Descriptors: *Scaling, *Inhibitors, *Nucleation, *Desalination, Chemical reactions, Chemistry of precipitation, Corrosion, Corrosion control, Flash evaporation, Crystal growth, Evaporation, Suspended solids.

Scale formation can cause corrosion and heat transfer problems in brine heaters of multistage flash evaporators for seawater desalination. Scale formation is a result of a fundamental chemical operation - the precipitation of sparingly soluble minerals. There are three basic steps for the formation of crystals; achievement of supersaturation, formation of crystal nuclei, and growth of nuclei to form crystals. Scale inhibitors are generally organic based compounds containing, either singly or in combination, anionic or nonionic groups such as carboxylic acid, ester, amino, thio, phosphono, or even ketoniec groups. Compounds with an open chain structure in solution are more effective than closed-ring compounds. Research at the Calgon Company is concerned with the two alkaline scale components, calcium carbonate and magnesium hydroxide. A multicomponent product is the only way to assure successful scale control. With a multi-component product, acystal modification and threshold inhibition are both likely to occur simultaneously, which is not the case with a single component compound. Factors affecting the adherence tendency of the scale should be considered. Fluid velocity is one such variable. Reduced fluid velocity results in increased residence time in the brine heater and a wider, more heat-resistant water layer next to the tube heating surface, meaning a greater percentage of brine exposed to higher temperatures for longer periods. A higher heat flux is also generally associated with a greater tendency to scale. The presence of corrosion products and the corrosion process itself can contribute to the deposit problem and also increase the tendency for the mineral scales to adhere. The nature of the metal surface, that is, the surface of the tubes, can also inherently affect scale adherence, as can surface roughness. (Baker-FRC)
W83-00970

8I. Fisheries Engineering

THE RELATION BETWEEN FISHERIES MANAGEMENT AND LIMNOLOGY,
McGill Univ., Montreal (Quebec), Dept. of Biology.
For primary bibliographic entry see Field 5C.
W83-00873

USE OF CONVENTIONAL FISHERY MODELS TO ASSESS ENTRAINMENT AND IMPINGEMENT OF THREE LAKE MICHIGAN FISH SPECIES,
Michigan Univ., Ann Arbor. School of Natural Resources.
A. L. Jensen, S. A. Spigarelli, and M. M. Thommes.
Transactions of the American Fisheries Society, Vol 111, No 1, p 21-34, January, 1982. 6 Fig, 9 Tab, 27 Ref.

Descriptors: *Fisheries, *Powerplants, *Impingement, *Enrichment, Lakes, Selective withdrawal, Drawdown, Water level, Model studies, Smelt, Perch, Fish, Fish populations, *Lake Michigan, Great Lakes, Alewife, Fish barriers, In take gates, Screens.

The entrainment of fish eggs and larvae in water passing through intake screens and impingement of larger fishes on intake screens during water withdrawal has caused concern. Two conventional stock assessment models were applied to estimate fish abundances and to simulate the impact on standing stocks and yields of water withdrawals from Lake Michigan. The most frequently impinged and entrained species in Lake Michigan are alewife, yellow perch, and rainbow smelt each of which is important commercially. Impingement and entrainment estimates were based on data collected at 15 powerplants. The surplus-production model was fitted to the three populations with catch and effort data from the commercial fisheries. Dynamic-pool model parameters were estimated from published data. The numbers entrained and impinged are large, but the proportions of the standing stocks impinged and the proportions of the eggs and larvae entrained are small. The reductions in biomass of the stocks and in maximum sustainable yields are larger than the proportions impinged. The reductions in biomass, based on 1975 data and on assumed full water withdrawal, are 2,86% for alewife, 0.75% for rainbow smelt, and 0.28% for yellow perch. Fishery models are an economical means of impact assessment in situations where catch and effort data are available for estimation of model parameters. (Baker-FRC)
W83-00891

CONTINUOUS WITHDRAWAL FROM SELECTED RESERVOIR STRATA.
For primary bibliographic entry see Field 8A.
W83-01043

10. SCIENTIFIC AND TECHNICAL INFORMATION

10F. Preparation Of Reviews

ACTIVATED SLUDGE,
Maryland Univ., College Park. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5D.
W83-00943

A REVIEW OF RAINWATER HARVESTING,
International Inst. for Land Reclamation and Improvement, Wageningen (Netherlands).
For primary bibliographic entry see Field 3B.
W83-01025

2
Synergistic Effect of Gibberellic Acid and Chlorflurenol on 2,4-D With Regard to Water Hyacinth,
W83-00745 4A

ABSORPTION
Methods of Analyzing Quinones in Water and Their Application in Studying the Effects of Hydrophytes on Phenols. Part 5: Elimination of Carcinogenic Amines From Solutions Under the Action of Nitella,
W83-00851 5D

ACID MINE DRAINAGE
Copper, Zinc, and Cadmium Concentrations of Resident Trout Related to Acid-Mine Wastes,
W83-00862 5B

ACID RAIN
The Availability of Private Remedies for Acid Rain Damage,
W83-00794 6E

The Cation Denudation Rate as a Quantitative Index of Sensitivity of Eastern Canadian Rivers to Acidic Atmospheric Precipitation,
W83-00955 5C

Modern and Paleolimnological Evidence for Accelerated Leaching and Metal Accumulation in Soils in New England, Caused by Atmospheric Deposition,
W83-00956 5B

Biological, Chemical and Physical Responses of Lakes to Experimental Acidification,
W83-00957 5C

Acidification of Nova Scotia Lakes I: Response of Diatom Assemblages in the Halifax Area,
W83-00960 5C

Effects of Experimental Acidification on Macroinvertebrate Drift Diversity in a Mountain Stream,
W83-00967 5C

ACIDIC WATER
Sodium Mobility in a Mini-Catchment Studied With Radioactive Tracers and Artificial Precipitation,
W83-00753 5B

Runoff Chemistry at a Mini-Catchment Watered With 'Unpolluted Precipitation,'
W83-00754 5B

ACIDITY
Liming of Acidified Lakes: Induced Long-Term Changes,
W83-00958 5G

Acidification of Nova Scotia Lakes I: Response of Diatom Assemblages in the Halifax Area,
W83-00960 5C

ACTIVATED SLUDGE PROCESS
Role of Phosphorus in Activated Sludge,
W83-00861 5D

Cooxidation of Benzo(A)Pyrene and Phenols on Activated Sludges,
W83-00866 5D

Activated Sludge,
W83-00943 5D

ADMINISTRATION
The Water Supply in Switzerland, A Survey of the Structure,
W83-01016 5F

ADSORPTION
The Uptake of Phosphate by Carex Species for Oligotrophic to Eutrophic Swamp Habitats,
W83-00874 5B

ADVECTION
Use of Deterministic and Empirical Models to Predict Potential Evapotranspiration in an Advective Environment,
W83-00825 2D

AERATION
The New 'Prinses Juliana' Water Extraction Plant of the Rhine-Kennemerland Water Transport Company,
W83-01013 5F

AERIAL PHOTOGRAPHY
Low-Level Aerial Infrared Images for Inventory of an Irrigated Area,
W83-00733 7B

AFRICA
Temporal and Spatial Variation of Rainfall Anomalies in Africa South of Latitude 22 Deg During the Period of Meteorological Record,
W83-00863 2B

AGRICULTRUAL WATERSHEDS
Sediment-Delivery Ratios for a Small Coastal Plain Agricultural Watershed,
W83-00869 2J

AGRICULTURAL CHEMICALS
The Effects of Nutrient, pH and Herbicide Levels on Algal Growth,
W83-00707 5C

AGRICULTURAL RUNOFF
Agricultural Runoff as a Nonpoint Externality: A Theoretical Development,
W83-00747 5B

AGRICULTURAL WATERSHEDS
Agricultural Runoff as a Nonpoint Externality: A Theoretical Development,
W83-00747 5B

AGRICULTURE
Water Resources Programs of the U.S. Geological Survey Related to Agriculture in Louisiana,
W83-01007 7C

AIR POLLUTION
Ecology of the Forest Stream Lane Bloto in the Niepolomice Forest 1. Chemism of Water and Bottom Sediments and its Changes Under the Influence of Industrial Pollution,
W83-00763 5B

Gas Chromatographic Analysis of Trace Hydrocarbon Pollutants in Water Samples,
W83-00800 5A

The Use of Calibrated Lakes and Watersheds for Estimating Atmospheric Deposition Near a Large Point Source,
W83-00953 5B

Lake Ontario Atmospheric Deposition, 1969-1978,
W83-00954 5B

Acidification of Nova Scotia Lakes I: Response of Diatom Assemblages in the Halifax Area,
W83-00960 5C

ALASKA
Evidence of Microbial Succession on Decaying Leaf Litter in an Arctic Lake,
W83-00848 2H

ALBERTA
The Importance of Groundwater in the Transportation of Allochthonous Dissolved Organic Matter to the Streams Draining a Small Mountain Basin,
W83-00710 2F

Drainage of an Irrigated Saline Soil in Alberta,
W83-00850 4A

Heterotrophic Activity and Biodegradation of Labile and Refractory Compounds by Groundwater and Stream Microbial Populations,
W83-01021 2F

ALFALFA
Yield of Alfalfa and Cotton as Influenced by Irrigation,
W83-00836 3F

ALGAE
Nature and Hydrocarbon Content of Blooms of the Alga Botryococcus Braunii Occurring in Australian Freshwater Lakes,
W83-00743 2H

Effect of Light Intensity of Sulfate Uptake and Primary Productivity by Natural Freshwater Microplankton Communities and Axenic Algal Cultures,
W83-00778 2H

Methods of Analyzing Quinones in Water and Their Application in Studying the Effects of Hydrophytes on Phenols. Part 5: Elimination of Carcinogenic Amines From Solutions Under the Action of Nitella,
W83-00851 5D

Algal Dynamics in Relation to Physico-Chemical Factors in a High Altitude Pond of Shillong, India,
W83-00853 2H

ALGAL GROWTH
The Effects of Nutrient, pH and Herbicide Levels on Algal Growth,
W83-00707 5C

In Situ Growth and Photosynthetic Characteristics of Oscillatoria Mougeotii in the Metalimnetic Layer of the Small Eutrophic Lake Nakanuma,
W83-00714 2H

Structure and Productivity of Epiphytic Algal Communities on Lobelia Dortmanna L. in Acidified and Limed Lakes,
W83-00959 5G

ALGERIA
Algerian Thermalism in its Geostructural Setting--How Hydrogeology has Helped in the Elucidation of Algeria's Deep-Seated Structure,
W83-00896 2F

ALLUVIAL CHANNELS
Steady Flow in Alluvial Channels,
W83-00940 2E

AMINES
Methods of Analyzing Quinones in Water and Their Application in Studying the Effects of Hydrophytes on Phenols. Part 5: Elimination of Carcinogenic Amines From Solutions Under the Action of Nitella,
W83-00851 5D

ANAEROBIC DIGESTION
Stabilization of Waste-Activated Sludge Through the Anoxic-Aerobic Digestion Process,
W83-00713 5E

ANTARCTICA
Pathway and Distribution of Trace Elements in Lake Vanda, Antarctica,
W83-00756 5B

ANTIBIOTICS
Selection of Antibiotic-Resistant Standard Plate Count Bacteria During Water Treatment,
W83-01020 5F

APALACHEE BAY
Long-Term Variation of Macroinvertebrate Assemblages in Apalachee Bay, Florida,
W83-00845 5C

APPARATUS
Standarization of Equipment and Facilities-An Important Prerequisite for Effective Production of Water-Related Equipment in Comecon Member Countries (Typisierung Von Ausrustugen und Anlagen - Wichtige Voraussetzung fur Eine Effektive Production Wasserwirtschaftlicher Ausrustungen in Den RGW-Mitgliedslandern,
W83-00978 5F

AQUATIC ANIMALS
Heavy Metals Pollution of the Upper Arkansas River, Colorado, and its Effects on the Distribution of the Aquatic Macrofauna,
W83-00921 5C

AQUATIC HABITATAT
Creation of Wetland Habitats in Northeastern Illinois,
W83-00944 5G

AQUATIC HABITATS
Environmental Effects of River Channel Works Used in Land Drainage Improvement,
W83-00952 6G

AQUATIC LIFE
Biotic Index Tested for Ability to Assess Water Quality of Missouri Ozark Streams,
W83-00728 5A

AQUATIC PLANTS
Synergistic Effect of Gibberellic Acid and Chlorflurenol on 2,4-D With Regard to Water Hyacinth,
W83-00745 4A

Status of Aquatic Macrophytes in an Undrained Area of Fen in the Norfolk Broads, England,
W83-00746 5C

Methods of Analyzing Quinones in Water and Their Application in Studying the Effects of Hydrophytes on Phenols. Part 3: Phenol Elimination Under the Action of Aquatic Plants,
W83-00852 5D

Transformation of Benzo(a)pyrene in a Mixture with Phenols under the Effect of Algae and Their Enzyme Preparations,
W83-00961 5B

AQUATIC WEED CONTROL
Aggregates of Particulate Matter and Aufwuchs on Elodea Canadensis in Irrigation Waters, and Inactivation of Diquat,
W83-00741 4A

On the Introduction of Phytophagous Fishes into Gravity-Flow Irrigation Systems in the Sudan,
W83-00783 4A

AQUIFER CHARACTERISTICS
A Nonlinear Optimisation Method for Aquifer Parameter Estimation.
W83-00905 2F

Laplace Transform Solutions for Solute Transport in Fissured Aquifers,
W83-01027 2F

AQUIFER MANAGEMENT
Numerical Modeling of Salt-Water Intrusion in the Northern Guam Lens,
W83-00946 4B

AQUIFER TESTING
Hydraulic Properties of a Major Alluvial Aquifer: An Isotropic, Inhomogeneous System--Reply,
W83-00898 2F

Hydraulic Properties of a Major Alluval Aquifer: An Isotropic, Inhomogeneous System--Comments,
W83-00899 2F

AQUIFERS
Hydrogeology of the Kufra and Sirte Basins, Eastern Libya,
W83-00725 2F

Hydrogeology of the Syrian Steppe and Adjoining Arid Areas,
W83-00726 2F

Hydrogeology of the Umm Er Radhuma Aquifer, Saudi Arabia, With Reference to Fossil Gradients,
W83-00727 2F

Hydrogeology of the Great Nubian Sandstone Basin, Egypt,
W83-00736 2F

The Value of Iodide as a Parameter in the Chemical Characterisation of Groundwaters,
W83-00901 2F

Numerical Modeling of Salt-Water Intrusion in the Northern Guam Lens,
W83-00946 4B

Water-Level Trends, Pumpage, and Chemical Quality in the Cambrian-Ordovician Aquifer in Illinois, 1971-1980,
W83-00947 6D

ARCH DAMS
Control of Pore Water Pressures at the Zervreila Arch Dam (Messen von Porenwasserdruck im Untergrund der Bogenstaumauer Zervreila),
W83-00973 8D

ARCTIC REGION
Evidence of Microbial Succession on Decaying Leaf Litter in an Arctic Lake,
W83-00848 2H

ARID CLIMATES
Hydrogeology of the Kufra and Sirte Basins, Eastern Libya,
W83-00725 2F

ARID LANDS
Use of Deterministic and Empirical Models to Predict Potential Evapotranspiration in an Advective Environment,
W83-00825 2D

ARID-ZONE HYDROLOGY
Hydrogeological Conditions in the Middle East,
W83-00724 2F

Hydrogeology of the Kufra and Sirte Basins, Eastern Libya,
W83-00725 2F

Hydrogeology of the Syrian Steppe and Adjoining Arid Areas,
W83-00726 2F

Hydrogeology of the Umm Er Radhuma Aquifer, Saudi Arabia, With Reference to Fossil Gradients,
W83-00727 2F

Hydrogeology of the Great Nubian Sandstone Basin, Egypt,
W83-00736 2F

ARIZONA
Seasonal Patterns of Soil Water Recharge and Extraction on Semidesert Ranges,
W83-00932 2G

ARKANSAS RIVER
Heavy Metals Pollution of the Upper Arkansas River, Colorado, and its Effects on the Distribution of the Aquatic Macrofauna,
W83-00921 5C

AROMATIC COMPOUNDS
Methods of Analyzing Quiones in Water and Their Application in Studying the Effects of Hydrophytes on Phenols. Part 1: Quinone Determination With Benzene Sulfinic Acid,
W83-00865 5A

AUSTRALIA
Nutrients and Phytoplankton in Three Shallow, Fresh-water Lakes of Different Trophic Status in Western Australia,
W83-00739 5C

Invertebrate Fauna and Ecology of Temporary Pools on Granite Outcrops in Southern Western Australia,
W83-00740 2H

Aggregates of Particulate Matter and Aufwuchs on Elodea Canadensis in Irrigation Waters, and Inactivation of Diquat,
W83-00741 4A

Limnology of Perched Lake, South-West Tasmania,
W83-00742 2H

Nature and Hydrocarbon Content of Blooms of the Alga Botryococcus Braunii Occurring in Australian Freshwater Lakes,
W83-00743 2H

Physical Properties of Great Barrier Reef Lagoon Waters Near Townsville. I. Effects of Burdekin River Floods,
W83-00759 2L

Equilibrium Status of Some Mineral Springs in Victoria,
W83-00760 2K

Primary Production in Three Lakes of Differing Salinity in Victoria, Australia,
W83-00775 2H

Shallow Dredging as a Strategy for the Control of Sublittoral Macrophytes: A Case Study in Tuggerah Lakes, New South Wales,
W83-00831 5G

Ecological Effects of Mine Effluents on the South Esk River, North-Eastern Tasmania, II. Trace Metals,
W83-00832 5B

Monte Carlo Study of the Nature of the Underwater Light Field in, and the Relationships Between Optical Properties of, Turbid Yellow Waters,
W83-01011 2H

AUTOMATION
An Automatic Recording Raingage Network for a Cloud-Seeding Experiment,
W83-00950 7A

Microelectronics - A Decisive Medium for the Realization of Automatic Telemetry Networks for Water Monitoring (Die Mikroelektronik - ein Entscheidendes Mittel bei der Realisierung Automatischer Fermnessnetze zue Gewasseruberwachung),
W83-00975 7A

Operations Monitoring System at the Helsinki City Waterworks,
W83-01032 5F

AZERBAIJAN
Information About the Origin of Thermomineral Waters and Gas by Means of Environmental Isotopes in Eastern Azerbaijan, Iran, and Southeast France,
W83-01050 2K

BACTERIA
Hydrogen as an Electron Donor for Sulfate-Reducing Bacteria in Slurries of Salt Marsh Sediment,
W83-00701 2L

Community Metabolism of Intertidal Flats in the Ems-Dollard Estuary,
W83-00702 2L

Vertical Distribution of Free-Living and Attached Heterotrophic Bacteria in Lake Kizaki,
W83-00718 2H

Seasonal Selection in a Freshwater Heterotrophic Bacterial Community,
W83-00758 2H

Bacterial Flora of the Water and Sediment in the Edo River Mouth (In Japanese),
W83-00781 5C

Exchange of Nitrate, and the Products of Bacterial Nitrate Reduction, Between Seawater and Sediments From a U.K. Saltmarsh,
W83-00812 2L

The Occurrence of Filamentous Fungi in Drinking Water Distribution Systems,
W83-00849 5F

Attached and Free-Floating Bacteria in the Fraser River Estuary, British Columbia, Canada,
W83-00879 2L

Biological Waste and Drinking Water Treatment: The Advantages of Bacterial Fixation on a Support,
W83-01018 5F

Selection of Antibiotic-Resistant Standard Plate Count Bacteria During Water Treatment,
W83-01020 5F

Heterotrophic Activity and Biodegradation of Labile and Refractory Compounds by Groundwater and Stream Microbial Populations,
W83-01021 2F

BACTERIAL ANALYSIS

Evaluation of Factors Affecting the Membrane Filter Technique for Testing Drinking Water,
W83-01019 5A

BALCONES ESCARPMENT

Mitigating Drought through Weather Modification: Selected Institutional and Meteorological Issues in Texas; Volume Two, Radar Echo Characteristics in the Edwards Plateau - Balcones Escarpment Area of Texas,
W83-00915 3B

BANKS

Physical Processes and Sedimentation on a Broad, Shallow Bank,
W83-00816 2J

BARLEY

Drought Sensitivity at Various Growth Stages of Barley in Relation to Relative Evapotranspiration and Water Stress,
W83-00838 3F

Crop Evaporation, Surface Resistance and Soil Water Status,
W83-00856 2I

BAYS

Seabed Drifter Movement in San Diego Bay and Adjacent Waters,
W83-00738 2L

BED LOAD

Hydraulic Interpretation of Grain-Size Distributions Using A Physical Model for Bedload Transport,
W83-00929 2J

BEDROCK

Control of Pore Water Pressures at the Zervreila Arch Dam (Messen von Porenwasserdruck im Untergrund der Bogenstaumauer Zervreila),
W83-00973 8D

BENTHIC ENVIRONMENT *STREAMS

Effects of Stream-Crossing by a Pipeline on the Benthic Macroinvertebrate Communities of a Small Mountain Stream,
W83-00789 5C

BENTHOS

Variable Effects of Sediment Addition on Stream Benthos,
W83-00730 4C

A Study of the Benthic Communities of Twenty Lakes in the South Island, New Zealand,
W83-00737 2H

A Device to Measure in Situ Lotic Benthic Metabolism,
W83-00773 5B

BENZOPYRENE

Transformation of Benzo(a)pyrene in a Mixture with Phenols under the Effect of Algae and Their Enzyme Preparations,
W83-00961 5B

BIBLIOGRAPHIES

A Review of Rainwater Harvesting,
W83-01025 3B

BIG BEAR LAKE

Limnology of a Eutrophic Reservoir: Big Bear Lake, California,
W83-00846 5C

BIGHTS

Temporal Variability of Suspended Particulate Concentrations in the New York Bight,
W83-01045 2J

BIOACCUMULATION

Copper, Zinc, and Cadmium Concentrations of Resident Trout Related to Acid-Mine Wastes,
W83-00862 5B

BIODEGRADATION

Examination and Evaluation of Biological Degrading of Metal Gluconate Complexes through the Zahn/Wallens Batch Method (Prufung und Bewertung der Biologischen Abbaubarkeit von me Gluconatkomplexen im Standversuch nach Zahn/Wellens),
W83-00972 5D

Heterotrophic Activity and Biodegradation of Labile and Refractory Compounds by Groundwater and Stream Microbial Populations,
W83-01021 2F

BIOINDICATORS

Biotic Index Tested for Ability to Assess Water Quality of Missouri Ozark Streams,
W83-00728 5A

Ciliated Protozoa and Water Quality in the Torrente Stirone (Northern Italy),
W83-00749 5C

BIOLOGICAL PROPERTIES

Biological, Chemical and Physical Responses of Lakes to Experimental Acidification,
W83-00957 5C

BIOLOGICAL TREATMENT

Biological Waste and Drinking Water Treatment: The Advantages of Bacterial Fixation on a Support,
W83-01018 5F

The Use of Bio-Technics in Water Treatment: Feasibility and Performance of Biological Treatment of Nitrates, (In French),
W83-01034 5F

BIOLOGICAL WASTEWATER TREATMENT

Activated Sludge,
W83-00943 5D

BIOMASS

The St. Lawrence River in Winter: Population Structure, Biomass, and Pattern of its Primary and Secondary Food Web Components,
W83-00779 2C

Attached and Free-Floating Bacteria in the Fraser River Estuary, British Columbia, Canada,
W83-00879 2L

BLOWOUTS

Howe Lake: A Hydrodynamic Blowout Structure,
W83-00847 2H

BORDER IRRIGATION

Evaluating Infiltration for Border Irrigation Models,
W83-01026 3F

BOREHOLES

Free Surface and Saturated-Unsaturated Analyses of Borehole Infiltration Tests Above the Water Table,
W83-01038 2G

BORON

A Comparison Study for Determining Dissolved Boron in Natural Water and Geothermal Fluid,
W83-00761 5A

BOTRYOCOCCUS BRAUNII

Nature and Hydrocarbon Content of Blooms of the Alga Botryococcus Braunii Occurring in Australian Freshwater Lakes,
W83-00743 2H

BOTTOM CURRENTS

Seabed Drifter Movement in San Diego Bay and Adjacent Waters,
W83-00738 2L

BOTTOM SEDIMENTS

The Behaviour of Methylene Blue Active Substance (MBAS) in Bottom Muds Under Laboratory Conditions,
W83-00717 2K

Distribution of Heavy Metals in Bottom Mud of Rivers VIII. Distribution of Total and Extractable Cd and Zn,
W83-00719 5B

Ecology of the Forest Stream Lane Bloto in the Niepolomice Forest 1. Chemism of Water and Bottom Sediments and its Changes Under the Influence of Industrial Pollution,
W83-00763 5B

BRACKISH WATER

Dynamics of Phytoplankton in the Brackish Water Inlet Pojoviken, Southern Coast of Finland,
W83-00709 2L

BRAZIL

Estuarine Metal Monitoring in Southern Brazil,
W83-00880 5B

BRITISH COLUMBIA

Attached and Free-Floating Bacteria in the Fraser River Estuary, British Columbia, Canada,
W83-00879 2L

CADMIUM

Trace Metal Content in the Lalbag Pond of Baroda City Near the Highway,
W83-00803 5B

Copper, Zinc, and Cadmium Concentrations of Resident Trout Related to Acid-Mine Wastes,
W83-00862 5B

CALCIUM SULFITE

Studies on Alkaline Earth Sulfites--III. Transient Solubilities and Phase Changes of Calcium Sulfite in Seawater,
W83-00712 3A

CALIFORNIA
Seabed Drifter Movement in San Diego Bay and Adjacent Waters,
W83-00738 2L

Laboratory Measurements of Reservoir Rock From the Geysers Geothermal Field, California,
W83-00770 8E

Water From Power: Water Supply and Regional Growth in the Santa Clara Valley,
W83-00795 6D

Use of Deterministic and Empirical Models to Predict Potential Evapotranspiration in an Advective Environment,
W83-00825 2D

Limnology of a Eutrophic Reservoir: Big Bear Lake, California,
W83-00846 5C

The Occurrence of Filamentous Fungi in Drinking Water Distribution Systems,
W83-00849 5F

Appendix to Report on Assessment of Low-Head Hydroelectric Sites in the Western States; Evaluation Reports for Low-Head Hydroelectric Sites, Part I - California.
W83-00923 8A

Water-Quality Assessment of the Smith River Drainage Basin, California and Oregon.
W83-01006 7C

CANADA
The Structure of Three-Dimensional Tide-Generating Currents: Experimental Verification of a Theoretical Model,
W83-00817 2L

Streamflow Anomaly Patterns in the U.S.A. and Southern Canada--1951-1970,
W83-00902 2E

The Politics of Water Pollution Control: A Case Study of the Canadian Fisheries Act Amendments and the Pulp and Paper Effluent Regulations, 1970,
W83-00951 6E

CARBON
Community Metabolism of Intertidal Flats in the Ems-Dollard Estuary,
W83-00702 2L

Carbon Isotope Composition of Organic Seston and Sediments in a Georgia Salt Marsh Estuary,
W83-00787 2L

CARCINOGENS
Methods of Analyzing Quinones in Water and Their Application in Studying the Effects of Hydrophytes on Phenols. Part 5: Elimination of Carcinogenic Amines From Solutions Under the Action of Nitella,
W83-00851 5D

CATIONS
The Cation Denudation Rate as a Quantitative Index of Sensitivity of Eastern Canadian Rivers to Acidic Atmospheric Precipitation,
W83-00955 5C

CHANNEL FLOW
Steady Flow in Alluvial Channels,
W83-00940 2E

CHANNEL IMPROVEMENT
Columbia River Entrance Channel Ship Motion Study,
W83-00935 8B

Movable-Bed Tidal Inlet Model,
W83-00941 2L

Environmental Effects of River Channel Works Used in Land Drainage Improvement,
W83-00952 6G

CHANNEL MORPHOLOGY
Steady Flow in Alluvial Channels,
W83-00940 2E

CHANNELS
Rating Curves for Rivers With Overbank Flow,
W83-00751 2E

A Comparison Between Vertically Integrated and Multilevel Models of Tidal Dynamics in Channels,
W83-00860 2L

New Method for Tidal Current Computation,
W83-00939 2L

CHEMICAL ANALYSIS
Estimation of Multiple Inflows to a Stream Reach Using Water Chemistry Data,
W83-00722 2E

Aquatic Distribution and Heterotrophic Degradation of Polycyclic Aromatic Hydrocarbons (PAH) in the Tamar Estuary,
W83-00808 5B

The Use of Calibrated Lakes and Watersheds for Estimating Atmospheric Deposition Near a Large Point Source,
W83-00953 5B

Lake Ontario Atmospheric Deposition, 1969-1978,
W83-00954 5B

CHEMICAL COMPOSITION
Pathway and Distribution of Trace Elements in Lake Vanda, Antarctica,
W83-00756 5B

Equilibrium Status of Some Mineral Springs in Victoria,
W83-00760 2K

CHEMICAL PROPERTIES
Biological, Chemical and Physical Responses of Lakes to Experimental Acidification,
W83-00957 5C

CHEMICAL REACTIONS
The Behaviour of Methylene Blue Active Substance (MBAS) in Bottom Muds Under Laboratory Conditions,
W83-00717 2K

Studies on the Decompositive Processes of Phytoplanktonic Organic Matter,
W83-00720 2H

Chemical Variability in the Tamar Estuary, South-West England,
W83-00807 2L

The Dynamics of Estuarine Manganese Cycling,
W83-00809 2L

CHILE
Clear Water from Coastal Fogs.
W83-00980 3B

CHINA
Unsteady Flow Studies in China,
W83-00936 8B

CHLORIDES
The Development of the Salt Problem in the Rhine in the 60's and 70's (Die Entwicklung des Salz-Problems am Rhein in den 60er und 70er Jahren).
W83-00785 5G

CHLORINATION
Reduction of Toxicity and Mutagenicity of Chlorination Effluents With Sulphur Dioxide,
W83-00764 5D

The Occurrence of Filamentous Fungi in Drinking Water Distribution Systems,
W83-00849 5F

CHROMATOGRAPHY
Determination of Trace Levels of Quaternary Ammonium Compounds in River Water by Liquid Chromatography With Conductometric Detection,
W83-00841 5A

Methods of Analyzing Quinones in Water and Their Application in Studying the Effects of Hydrophytes on Phenols. Part 1: Quinone Determination With Benzene Sulfinic Acid,
W83-00865 5A

CHROMIUM
Spectrophotometric Determination of Microgram Amounts of Chromium(VI) and Total Chromium in Waste Water,
W83-00768 5A

CHUTES
Chute Spillway Design Calculations,
W83-00765 8A

CILIATES
Ciliated Protozoa and Water Quality in the Torrente Stirone (Northern Italy),
W83-00749 5C

CLIMATIC ZONES
Streamflow Anomaly Patterns in the U.S.A. and Southern Canada--1951-1970,
W83-00902 2E

CLIMATOLOGY
Reconstruction of Past Ice Conditions in a Hudson Bay Estuary Using Tree Rings,
W83-00766 2C

Temporal and Spatial Variation of Rainfall Anomalies in Africa South of Latitude 22 Deg During the Period of Meteorological Record,
W83-00863 2B

CLOUD SEEDING
Aircraft Measurements of Icing in Supercooled and Water Droplet Ice Crystal Clouds,
W83-00948 3B

Formation of Ice Crystals and Dissipation of Supercooled Fog by Artificial Nucleation, and Variations of Crystal Habit at Early Growth Stages,
W83-00949 3B

An Automatic Recording Raingage Network for a Cloud-Seeding Experiment,
W83-00950 7A

Rainfall Results of the Florida Area Cumulus Experiment, 1970-76,
W83-00962 3B

COALS
Hydrology of the Prairie Dog Creek Drainage Basin, Rosebud and Big Horn Counties, Montana,
W83-00990 7C

COASTAL AQUIFERS
Numerical Modeling of Salt-Water Intrusion in the Northern Guam Lens,
W83-00946 4B

COASTAL PLAINS
Sediment-Delivery Ratios for a Small Coastal Plain Agricultural Watershed,
W83-00869 2J

COASTAL WATERS
Copepod Communities in the Estuary and Coastal Plume of the Hudson River,
W83-00813 2L

COLIFORMS
Evaluation of Factors Affecting the Membrane Filter Technique for Testing Drinking Water, W83-01019 5A

COLORADO
Estimation of Multiple Inflows to a Stream Reach Using Water Chemistry Data, W83-00722 2E

Water Loss From a Shortgrass Steppe, W83-00855 2D

Heavy Metals Pollution of the Upper Arkansas River, Colorado, and its Effects on the Distribution of the Aquatic Macrofauna, W83-00921 5C

Appendix to Report on Assessment of Low-Head Hydroelectric Sites in the Western State; Evaluation Reports for Low-Head Hydroelectric Sites, Part II - Colorado. W83-00924 8A

Water Resources Data, Colorado, Water Year 1981--Volume 1. Missouri River Basin, Arkansas River Basin, and Rio Grande Basin. W83-00995 7C

Water Resources Data, Colorado, Water Year 1981--Volume 2. Colorado River Basin Above Dolores River. W83-00996 7C

COLORIMETRY
A Comparison Study for Determining Dissolved Boron in Natural Water and Geothermal Fluid, W83-00761 5A

COLUMBIA RIVER
Columbia River Entrance Channel Ship Motion Study, W83-00935 8B

COMECON
Standarization of Equipment and Facilities-An Important Prerequisite for Effective Production of Water-Related Equipment in Comecon Member Countries (Typisierung Von Ausrustugen und Anlagen - Wichtige Voraussetzung fur Eine Effektive Production Wasserwirtschaftlicher Ausrustungen in Den RGW-Mitgliedslandern, W83-00978 5F

COMPUTER MODELS
Computer-Supported Flood Predictions for the Improvement of flood Protection in the DDR (Rechnergestutzte Hochwasservorhersagen zue Verbesserung des Hochwasserschutzes in der DDR), W83-00976 2E

COMPUTERS
Microelectronics - A Decisive Medium for the Realization of Automatic Telemetry Networks for Water Monitoring (Die Mikroelektronik - ein Entscheidendes Mittel bei der Realisierung Automatischer Fermnessnetze zue Gewasseruberwachung), W83-00975 7A

CONCENTRATION TIME
Time of Concentration and Storage Coefficient Values for Illinois Streams, W83-00986 2A

A Technique for Estimating Time of Concentration and Storage Coefficient Values for Illinois Streams, W83-00988 2A

CONDUCTIVITY
The Three-Parameter Infiltration Equation, W83-00734 2G

CONFERENCES
ECE Water Committee Recommends Declaration on Water Pollution. W83-00797 5G

CONFINED AQUIFERS
Seawater Intrusion in Continuous Coastal Aquifer-Aquitard Systems, W83-01028 2F

CONNATE WATER
Hydrogeological Conditions in the Middle East, W83-00724 2F

CONNECTICUT
A Method for Estimating the 7-Day, 10-Year Low Flow of Streams in Connecticut, W83-00991 2E

Streamflow Information for Connecticut with Applications to Land-Use Planning, W83-00992 3E

CONSTRUCTION
Kielder Water (UK) Project Has Royal Opening. W83-01033 8A

COOLING WATER
Economics of the Water Blanket Technique for Greenhouse Heating, W83-00762 3C

COPEPODS
Interactions Between Suspended Organic Matter and Copepod Grazing in the Plume of the Hudson River, W83-00793 2L

Copepod Communities in the Estuary and Coastal Plume of the Hudson River, W83-00813 2L

COPPER
The Significance of Natural Environmental Factors in the Distribution of Copper in Potable Waters of Sri-Lanka, W83-00798 5B

Copper, Zinc, and Cadmium Concentrations of Resident Trout Related to Acid-Mine Wastes, W83-00862 5B

CORN
Predicting the Effects of Drainage Systems on Corn Yields, W83-00748 4A

Irrigation Scheduling Using Crop Canopy-Air Temperature Difference, W83-00887 3F

CORRELATION COEFFICIENT
Rainfall Interstation Correlation Functions IV. On the Occurrence of Zero and Less-Than-Zero Response, W83-00912 2B

COST ANALYSIS
The Design of Looped Water Distribution Networks by Application of Linear Programming (Die Dimensionierung Von Vermaschten Wasserverteilungsnetzen Unter Anwendung Der Linearen Programmierung), W83-00772 8B

Report on Assessment of Low-Head Hydroelectric Sites in the Western States; Methology and Summary. W83-00922 6C

Appendix to Report on Assessment of Low-Head Hydroelectric Sites in the Western States; Evaluation Reports for Low-Head Hydroelectric Sites, Part I - California. W83-00923 8A

Appendix to Report on Assessment of Low-Head Hydroelectric Sites in the Western State; Evaluation Reports for Low-Head Hydroelectric Sites, Part II - Colorado. W83-00924 8A

Appendix to Report on Assessment of Low-Head Hydroelectric Sites in the Western States; Evaluation Reports for Low-Head Hydroelectric Sites, Part III - Idaho and Utah. W83-00925 8A

Appendix to Report of Assessment of Low-Head Hydroelectric Sites in the Western States; Evaluation Reports for Low-Head Hydroelectric Sites, Part IV - Kansas, New Mexico, Oklahoma, and Texas. W83-00926 8A

Appendix to Report on Assessment of Low-Head Hydroelectric Sites in the Western States; Evaluation Reports for Low-Head Hydroelectric Sites, Part V - Montana and Wyoming. W83-00927 8A

Appendix to Report on Assessment of Low-Head Hydroelectric Sites in the Western States; Evaluation Reports for Low-Head Hydroelectric Sites, Part VI - Oregon and Washington. W83-00928 8A

COST-BENEFIT ANALYSIS
Distributional Constraints on Acceptance of Nonpoint Pollution Controls, W83-00829 6C

Creation of Wetland Habitats in Northeastern Illinois, W83-00944 5G

The Feasibility and Benefits of Reclaiming a Man-Made Lake: A Case Study of Lake Paradise, Mattoon, Illinois, W83-00945 6B

COTTON
Yield of Alfalfa and Cotton as Influenced by Irrigation, W83-00836 3F

CROP PRODUCTION
Evapotranspiration Studies on Rice in Relation to Water Use Efficiency, W83-00868 3F

CROP YIELD
Utility of Frequency Distribution of Moisture Adequacy in the Selection of Crops for Areas With Marginal Rainfall, W83-00806 3F

Influence of Irrigation of the Development and Yield of Potatoes, W83-00833 3F

Moisture-Sensitive Growth Stages of Dwarf Wheat and Optimal Sequencing of Evapotranspiration Deficits, W83-00834 3F

Afternoon Water Deficits and Grain Yields in Old and New Soybean Cultivars, W83-00837 3F

Drought Sensitivity at Various Growth Stages of Barley in Relation to Relative Evapotranspiration and Water Stress, W83-00838 3F

Comparison of Sprinkler, Trickle, Subsurface, and Furrow Irrigation Methods for Row Crops, W83-00840 3F

CROP YIELDS
Predicting the Effects of Drainage Systems on Corn Yields, W83-00748 4A

CRYSTALS
Aircraft Measurements of Icing in Supercooled and Water Droplet Ice Crystal Clouds,
W83-00948 3B

Formation of Ice Crystals and Dissipation of Supercooled Fog by Artificial Nucleation, and Variations of Crystal Habit at Early Growth Stages,
W83-00949 3B

DAM DESIGN
Hydraulic Model Study of Choke Canyon Dam Spillway and Stilling Basin,
W83-00918 8A

DAMS
Calculations on a Model for the Future Behaviour of Griesgletscher, Wallis (Modellrechnungen zum Zukunftigen Verhalten des Griesgletschers, Wallis),
W83-00982 2C

DAPHNIA
Daphnia in Lake Washington,
W83-00703 2H

DATA COLLECTIONS
Water Quality of the Tidal Potomac River and Estuary, Hydrologic Data Report, 1980 Water Year,
W83-00984 7C

Water Type and Suitability of Oklahoma Surface Waters for Public Supply and Irrigation. Part 2: Salt Fork Arkansas River and Cimarron River Basins Through 1978,
W83-00989 7C

Hydrology of the Prairie Dog Creek Drainage Basin, Rosebud and Big Horn Counties, Montana,
W83-00990 7C

Water Resources Programs of the U.S. Geological Survey Related to Agriculture in Louisiana,
W83-01007 7C

U.S. Geological Survey Activities, Fiscal Year 1981.
W83-01009 7C

DECAYING ORGANIC MATTER
Evidence of Microbial Succession on Decaying Leaf Litter in an Arctic Lake,
W83-00848 2H

DECOMPOSING ORGANIC MATTER
Studies on the Decompositive Processes of Phytoplanktonic Organic Matter,
W83-00720 2H

DEGRADATION
Methods of Analyzing Quinones in Water and Their Application in Studying the Effects of Hydrophytes on Phenols. Part 3: Phenol Elimination Under the Action of Aquatic Plants,
W83-00852 5D

Transformation of Benzo(a)pyrene in a Mixture with Phenols under the Effect of Algae and Their Enzyme Preparations,
W83-00961 5B

DEICERS
Hydrologic Effects of Highway-Deicing Chemicals in Massachusetts--Executive Summary,
W83-01008 4C

DELAWARE
Trace Metal Partitioning in the Aqueous Surface Microlayer of a Salt Marsh,
W83-00814 5B

DENITRIFICATION
Design of Combined Nitrification-Dentrification Plants (Bemessung von Kombinierten Nitrifikations-und Denitrifikationsanlagen),
W83-00786 5D

Exchange of Nitrate, and the Products of Bacterial Nitrate Reduction, Between Seawater and Sediments From a U.K. Saltmarsh,
W83-00812 2L

The Use of Bio-Technics in Water Treatment: Feasibility and Performance of Biological Treatment of Nitrates, (In French),
W83-01034 5F

DENMARK
Vulnerability Maps: A Promising Tool in Groundwater Protection,
W83-01012 5G

DESALINATION
Studies on Alkaline Earth Sulfites--III. Transient Solubilities and Phase Changes of Calcium Sulfite in Seawater,
W83-00712 3A

RO Suppliers Look to Wind and Sun to Power Rural Systems.
W83-00969 3A

How Inhibitors Improve Economics of Scale,
W83-00970 8G

Desalter Systems for Man-Made Islands,
W83-00979 3A

DESIGN CRITERIA
Chute Spillway Design Calculations,
W83-00765 8A

The Design of Looped Water Distribution Networks by Application of Linear Programming (Die Dimensionierung Von Vermaschten Wasserverteilungsnetzen Unter Anwendung Der Linearen Programmierung),
W83-00772 8B

Design of Combined Nitrification-Dentrification Plants (Bemessung von Kombinierten Nitrifikations-und Denitrifikationsanlagen),
W83-00786 5D

Construction, Operation and Maintenance of Gravel Wells,
W83-00966 8A

Investigation into Water Exchange in Reservoirs of Different Shapes and Different Arrangement of Inlet and Discharge Pipes,
W83-01035 5G

DESIGN STANDARDS
Standarization of Equipment and Facilities-An Important Prerequisite for Effective Production of Water-Related Equipment in Comecon Member Countries (Typisierung Von Ausrustugen und Anlagen - Wichtige Voraussetzung fur Eine Effektive Production Wasserwirtschaftlicher Ausrustungen in Den RGW-Mitgliedslandern,
W83-00978 5F

DETERGENTS
The Behaviour of Methylene Blue Active Substance (MBAS) in Bottom Muds Under Laboratory Conditions,
W83-00717 2K

DIATOMS
Acidification of Nova Scotia Lakes I: Response of Diatom Assemblages in the Halifax Area,
W83-00960 5C

DIFFUSION
Finite Element Analysis of Horizontal and Vertical Turbulent Diffusion Problems in Lakes,
W83-01040 2H

DIGESTION
Stabilization of Waste-Activated Sludge Through the Anoxic-Aerobic Digestion Process,
W83-00713 5E

DIQUAT
Aggregates of Particulate Matter and Aufwuchs on Elodea Canadensis in Irrigation Waters, and Inactivation of Diquat,
W83-00741 4A

DISCHARGE HYDROGRAPHS
Cyclical Relationships Between River Discharge and Chemical Concentration During Flood Events,
W83-01046 2E

DISPOSAL
Open Ocean Disposal of Materials Dredged from a Highly Industrialized Estuary: An Evaluation of Potential Lethal Effects,
W83-01030 5E

DISSOLVED SOLIDS
The Importance of Groundwater in the Transportation of Allochthonous Dissolved Organic Matter to the Streams Draining a Small Mountain Basin,
W83-00710 2F

DISTILLATION
Desalter Systems for Man-Made Islands,
W83-00979 3A

DRAINAGE
A Model for the Design of Drainage in Flat Agricultural Lands,
W83-00820 4A

Drainage of an Irrigated Saline Soil in Alberta,
W83-00850 4A

Incorporating Crop Needs Into Drainage System Design,
W83-00886 3F

DRAINAGE EFFECTS
Environmental Effects of River Channel Works Used in Land Drainage Improvement,
W83-00952 6G

DRAINAGE SYSTEMS
Predicting the Effects of Drainage Systems on Corn Yields,
W83-00748 4A

Prediction and Control of Porosity and Water Retention in Sand-Soil Mixtures for Drained Turf Sites,
W83-00822 2G

DREDGING
Shallow Dredging as a Strategy for the Control of Sublittoral Macrophytes: A Case Study in Tuggerah Lakes, New South Wales,
W83-00831 5G

The Feasibility and Benefits of Reclaiming a Man-Made Lake: A Case Study of Lake Paradise, Mattoon, Illinois,
W83-00945 6B

DRINKING WATER
Experience With the EEC Directive 75/440 on the Quality of Surface Water for Drinking Water Procurement in the Member States (Erfahrungen Mit Der Eg-Richtlinie 75/440 Uber Die Qualitat Von Oberflachenwasser Fur Die Trink-Wassergewinnung in Den Mitgliedsstaaten),
W83-00771 6F

The Significance of Natural Environmental Factors in the Distribution of Copper in Potable Waters of Sri-Lanka,
W83-00798 5B

The Occurrence of Filamentous Fungi in Drinking Water Distribution Systems,
W83-00849 5F

Full Marks for Oxfam's Water Supply Package.
W83-00968 5F

Unified Management of Water Supply in Taiwan.
W83-01015 5F

The Water Supply in Switzerland, A Survey of the Structure,
W83-01016 5F

Evaluation of Factors Affecting the Membrane Filter Technique for Testing Drinking Water,
W83-01019 5A

Diffused Type Pollution Control for Catchment Areas of Rivers Used to Provide Drinking Water,
W83-01031 5G

DRIP IRRIGATION
Drip Irrigation Lateral Line Network Design,
W83-00888 3F

DROUGHT
Drought Sensitivity at Various Growth Stages of Barley in Relation to Relative Evapotranspiration and Water Stress,
W83-00838 3F

The Performance of Appropriative Water Rights Systems in the Western United States During Drought,
W83-00882 6E

Mitigating Drought Through Weather Modification: Selected Institutional and Meteorological Issues in Texas; Volume One, Texas Advisory Commission on Intergovernmental Relations,
W83-00914 3B

Mitigating Drought through Weather Modification: Selected Institutional and Meteorological Issues in Texas; Volume Two, Radar Echo Characteristics in the Edwards Plateau - Balcones Escarpment Area of Texas,
W83-00915 3B

DUSTS
Titanium and Tungsten in Highway Runoff at Pullman, Washington,
W83-00799 5B

DYE DISPERSION
Measurement of Time of Travel and Dispersion in Streams by Dye Tracing,
W83-00985 5B

DYE RELEASES
Measurement of Time of Travel and Dispersion in Streams by Dye Tracing,
W83-00985 5B

ECOLOGICAL EFFECTS
Environmental Effects of River Channel Works Used in Land Drainage Improvement,
W83-00952 6G

ECONOMIC ASPECTS
Agricultural Runoff as a Nonpoint Externality: A Theoretical Development,
W83-00747 5B

Reducing the Cost of Water Pollution Control Under the Clean Water Act,
W83-00757 6E

Socioeconomic Value of the Trout Fishery in Lake Taneycomo, Missouri,
W83-00872 6C

ECOSYSTEMS
Are New Zealnd Stream Ecosystems Really Different.,
W83-00885 2J

EDDIES
Hydromechanics of Tidal Jets,
W83-00938 2L

EDWARDS PLATEAU
Mitigating Drought Through Weather Modification: Selected Institutional and Meteorological Issues in Texas; Volume One, Texas Advisory Commission on Intergovernmental Relations,
W83-00914 3B

Mitigating Drought through Weather Modification: Selected Institutional and Meteorological Issues in Texas; Volume Two, Radar Echo Characteristics in the Edwards Plateau - Balcones Escarpment Area of Texas,
W83-00915 3B

Mitigating Drought Through Weather Modification: Selected Institutional and Meteorological Issues in Texas; Volume Three, Precipitation Climatology for the Edwards Plateau Region of Texas,
W83-00916 3B

Mitigating Drought Through Weather Modification: Selected Institutional and Meteorological Issues in Texas; Volume Four, an Objective Study of the Upper-Air Conditions Relating to Precipitation Over the Southeastern Section of the Edwards Plateau in Texas,
W83-00917 3B

EGYPT
Hydrogeology of the Great Nubian Sandstone Basin, Egypt,
W83-00736 2F

ELBE RIVER
Computer-Supported Flood Predictions for the Improvement of flood Protection in the DDR (Rechnergestutzte Hochwasservorhersagen zue Verbesserung des Hochwasserschutzes in der DDR),
W83-00976 2E

ELEVATION
Mitigating Drought Through Weather Modification: Selected Institutional and Meteorological Issues in Texas; Volume Three, Precipitation Climatology for the Edwards Plateau Region of Texas,
W83-00916 3B

ELODEA CANADENSIS
Aggregates of Particulate Matter and Aufwuchs on Elodea Canadensis in Irrigation Waters, and Inactivation of Diquat,
W83-00741 4A

ENERGY SOURCES
Economics of the Water Blanket Technique for Greenhouse Heating,
W83-00762 3C

ENGLAND
Hydrogen as an Electron Donor for Sulfate-Reducing Bacteria in Slurries of Salt Marsh Sediment,
W83-00701 2L

Status of Aquatic Macrophytes in an Undrained Area of Fen in the Norfolk Broads, England,
W83-00746 5C

Aspects of the Biology of Estuarine Fish Populations Sampled From Power Station Trash Screens,
W83-00802 5C

Chemical Variability in the Tamar Estuary, South-West England,
W83-00807 2L

Aquatic Distribution and Heterotrophic Degradation of Polycyclic Aromatic Hydrocarbons (PAH) in the Tamar Estuary,
W83-00808 5B

The Dynamics of Estuarine Manganese Cycling,
W83-00809 2L

Exchange of Nitrate, and the Products of Bacterial Nitrate Reduction, Between Seawater and Sediments From a U.K. Saltmarsh,
W83-00812 2L

The Application of Radioisotopes in the Study of Estuarine Sedimentary Processes,
W83-00818 5B

The Value of Iodide as a Parameter in the Chemical Characterisation of Groundwaters,
W83-00901 2F

Cyclical Relationships Between River Discharge and Chemical Concentration During Flood Events,
W83-01046 2E

ENRICHMENT
Use of Conventional Fishery Models to Assess Entrainment and Impingement of Three Lake Michigan Fish Species,
W83-00891 8I

Determination of Geohydraulic Parameters and the Infiltration Capacity of Sand Basins for Artificial Groundwater Enrichment (Bestimmung der Geohydraulischen Parameter und der Infiltrationsleistung von Sandbecken bei Kunstlicher Grundwasseranreicherung),
W83-00983 5G

ENVIRONMENTAL EFFECTS
Environmental Effects of River Channel Works Used in Land Drainage Improvement,
W83-00952 6G

ENVIRONMENTAL POLICY
Agricultural Runoff as a Nonpoint Externality: A Theoretical Development,
W83-00747 5B

EPHEMERAL LAKES
Invertebrate Fauna and Ecology of Temporary Pools on Granite Outcrops in Southern Western Australia,
W83-00740 2H

EPILIMNION
Diurnal Change of 14C-Glucose Uptake by Epilimnetic Microbes in Lake Kizaki,
W83-00715 2H

EQUILIBRIUM
Equilibrium Status of Some Mineral Springs in Victoria,
W83-00760 2K

EROSION CONTROL
Soil Erosion and Runoff From Planting to Canopy Development as Influenced by Tractor Wheel-Traffic,
W83-00889 4D

EROSION EFFECTS
Impact of Incremental Surface Soil Depths on Infiltrations Rates, Potential Sediment Losses, and Chemical Water Quality,
W83-00934 2J

ERROR ANALYSIS
Raingauge Network Reduction,
W83-00900 7A

ESTIMATED BENEFITS
The Feasibility and Benefits of Reclaiming a Man-Made Lake: A Case Study of Lake Paradise, Mattoon, Illinois,
W83-00945 6B

ESTIMATING
Estimation of Multiple Inflows to a Stream Reach Using Water Chemistry Data,
W83-00722 2E

The Estimation of Rain From Satellite-Borne Microwave Radiometers,
W83-00876 2B

A Technique for Estimating Time of Concentration and Storage Coefficient Values for Illinois Streams,
W83-00988 2A

ESTIMATING EQUATIONS

Estimation of the Scattering Coefficient of Natural Waters Using Underwater Irradiance Measurements,
W83-00744 1A

ESTUARIES

Carbon Isotope Composition of Organic Seston and Sediments in a Georgia Salt Marsh Estuary,
W83-00787 2L

Aquatic Distribution and Heterotrophic Degradation of Polycyclic Aromatic Hydrocarbons (PAH) in the Tamar Estuary,
W83-00808 5B

The Dynamics of Estuarine Manganese Cycling,
W83-00809 2L

Local Variability in the Distribution of Windscale Fission Products in Estuarine Sediments,
W83-00810 5B

Sediment Nutrient Regeneration in Three North Carolina Estuaries,
W83-00811 2L

Exchange of Nitrate, and the Products of Bacterial Nitrate Reduction, Between Seawater and Sediments From a U.K. Saltmarsh,
W83-00812 2L

The Application of Radioisotopes in the Study of Estuarine Sedimentary Processes,
W83-00818 5B

Long-Term Variation of Macroinvertebrate Assemblages in Apalachee Bay, Florida,
W83-00845 5C

Natural Fluorescence as a Tracer for Distinguishing Between Piedmont and Coastal Plain River Water in the Nearshore Waters of Georgia and North Carolina,
W83-00857 2L

Ebb-Tidal Flow Characteristics Near Inlets,
W83-00859 2L

Estuarine Metal Monitoring in Southern Brazil,
W83-00880 5B

A Field Study of Estuarine Pollution in Madras, India,
W83-00881 5B

Unsteady Flow Studies in China,
W83-00936 8B

Water Quality of the Tidal Potomac River and Estuary, Hydrologic Data Report, 1980 Water Year,
W83-00984 7C

Metal Sulfides in Estuarine Sediments,
W83-01044 5B

ESTUARINE ENVIRONMENT

High Resolution Vertical Profiles of pH in Recent Sediments,
W83-00729 5B

Physical Characteristics of an Inshore Area on the Atlantic Coast of Brittany and Their Influence on the Pelagic Ecosystem: The Case of the 'Riviere D'Etel',
W83-00792 2L

Environmental Characteristics of the Mandovi-Zuari Estuarine System in Goa,
W83-00804 2L

The Structure of Three-Dimensional Tide-Generating Currents: Experimental Verification of a Theoretical Model,
W83-00817 2L

Local Energy Exchanges in a Shallow, Coastal Lagoon: Winter Conditions,
W83-00858 2L

Attached and Free-Floating Bacteria in the Fraser River Estuary, British Columbia, Canada,
W83-00879 2L

ETHYLATION

Determination of Sulphide Ion at Trace Levels by Ethylation and Gas Chromatography,
W83-00805 5A

EUROPE

Application of Multiple Discriminant Analysis on the Analysis of the Correlation Between Macrophyte Vegetation and Water Quality in Running Waters of Central Europe,
W83-00776 5A

EUROPEAN ECONOMIC COMMUNITY

Experience With the EEC Directive 75/440 on the Quality of Surface Water for Drinking Water Procurement in the Member States (Erfahrungen Mit Der Eg-Richtlinie 75/440 Uber Die Qualitat Von Oberflachenwasser Fur Die Trink-Wassergewinnung in Den Mitgliedsstaaten),
W83-00771 6F

EURTOPHICATION

Concepts for the Modelling of the Phosphorus Cycle in Lakes and Reservoirs (Modellvorstellungen uber den Phosphorkreislauf in Stehenden Gewassern),
W83-00971 5C

EUTROPHIC LAKES

Limnology of Heart Lake, Ontario,
W83-00774 2H

EUTROPHICATION

The Trophic Response of Ciliated Protozoans in Freshwater Lakes,
W83-00704 5C

Records of a Lakes' Life in Time: The Sediments,
W83-00708 5C

Nature and Hydrocarbon Content of Blooms of the Alga Botryococcus Braunii Occurring in Australian Freshwater Lakes,
W83-00743 2H

Limnology of a Eutrophic Reservoir: Big Bear Lake, California,
W83-00846 5C

EVAPORATION

Crop Evaporation, Surface Resistance and Soil Water Status,
W83-00856 2I

The Significance of Surface Temperature Patterns on the Energy Balance of a Small Lake in the Canadian Shield,
W83-01029 2H

EVAPOTRANSPIRATION

Daily Patterns of Apparent Photosynthesis and Evapotranspiration in a Developing Winter Wheat Crop,
W83-00823 2D

Modeling Soybean Leaf-Water Potentials Under Nonlimiting Soil Water Conditions,
W83-00824 2I

Use of Deterministic and Empirical Models to Predict Potential Evapotranspiration in an Advective Environment,
W83-00825 2D

Design and Testing of a Microlysimeter for Wetland Rice,
W83-00826 2D

Water Use by Wheat and Plant Indicators of Available Soil Water,
W83-00828 2I

Moisture-Sensitive Growth Stages of Dwarf Wheat and Optimal Sequencing of Evapotranspiration Deficits,
W83-00834 3F

Yield of Alfalfa and Cotton as Influenced by Irrigation,
W83-00836 3F

Drought Sensitivity at Various Growth Stages of Barley in Relation to Relative Evapotranspiration and Water Stress,
W83-00838 3F

Water Loss From a Shortgrass Steppe,
W83-00855 2D

Evapotranspiration Studies on Rice in Relation to Water Use Efficiency,
W83-00868 3F

EXPLORATION

The Los Azufres, Michoacan, Mexico, Geothermal Field,
W83-00903 2F

FATE OF POLLUTANTS

The Significance of Natural Environmental Factors in the Distribution of Copper in Potable Waters of Sri-Lanka,
W83-00798 5B

Titanium and Tungsten in Highway Runoff at Pullman, Washington,
W83-00799 5B

FEASIBILITY STUDIES

Appendix to Report on Assessment of Low-Head Hydroelectric Sites in the Western States; Evaluation Reports for Low-Head Hydroelectric Sites, Part I - California.
W83-00923 8A

Appendix to Report on Assessment of Low-Head Hydroelectric Sites in the Western State; Evaluation Reports for Low-Head Hydroelectric Sites, Part II - Colorado.
W83-00924 8A

Appendix to Report on Assessment of Low-Head Hydroelectric Sites in the Western States; Evaluation Reports for Low-Head Hydroelectric Sites, Part III - Idaho and Utah.
W83-00925 8A

Appendix to Report of Assessment of Low-Head Hydroelectric Sites in the Western States; Evaluation Reports for Low-Head Hydroelectric Sites, Part IV - Kansas, New Mexico, Oklahoma, and Texas.
W83-00926 8A

Appendix to Report on Assessment of Low-Head Hydroelectric Sites in the Western States; Evaluation Reports for Low-Head Hydroelectric Sites, Part V - Montana and Wyoming.
W83-00927 8A

Appendix to Report on Assessment of Low-Head Hydroelectric Sites in the Western States; Evaluation Reports for Low-Head Hydroelectric Sites, Part VI - Oregon and Washington.
W83-00928 8A

FEDERAL JURISDICTION
Distributional Constraints on Acceptance of Nonpoint Pollution Controls,
W83-00829 6C

FEDERAL REPUBLIC OF GERMANY
Design and Construction of Flexible Groynes (Entwurf und bau Flexibler Buhnen),
W83-00974 8B

FENS
Status of Aquatic Macrophytes in an Undrained Area of Fen in the Norfolk Broads, England,
W83-00746 5C

FINITE ELEMENT METHOD
Accuracy of Finite Element Solutions of Navier-Stokes Equations Using a Velocity-Pressure Formulation,
W83-01039 2E

Galerkin Finite Element Method and the Groundwater Flow Equation: 1. Convergence of the Method,
W83-01041 2F

FINLAND
Dynamics of Phytoplankton in the Brackish Water Inlet Pojoviken, Southern Coast of Finland,
W83-00709 2L

Operations Monitoring System at the Helsinki City Waterworks,
W83-01032 5F

FISH
On the Introduction of Phytophagous Fishes into Gravity-Flow Irrigation Systems in the Sudan,
W83-00783 4A

Copper, Zinc, and Cadmium Concentrations of Resident Trout Related to Acid-Mine Wastes,
W83-00862 5B

Use of Fish Ventilation Frequency to Estimate Chronically Safe Toxicant Concentrations,
W83-00892 5C

FISH MANAGEMENT
The Relation Between Fisheries Management and Limnology,
W83-00873 5C

FISH POPULATIONS
A Procedure to Estimate Changes in Fish Populations Caused by Changes in Stream Discharge,
W83-00705 2E

Aspects of the Biology of Estuarine Fish Populations Sampled From Power Station Trash Screens,
W83-00802 5C

A Field Study of Estuarine Pollution in Madras, India,
W83-00881 5B

FISHERIES
Socioeconomic Value of the Trout Fishery in Lake Taneycomo, Missouri,
W83-00872 6C

The Relation Between Fisheries Management and Limnology,
W83-00873 5C

Use of Conventional Fishery Models to Assess Entrainment and Impingement of Three Lake Michigan Fish Species,
W83-00891 8I

FISSURE WATER
Laplace Transform Solutions for Solute Transport in Fissured Aquifers,
W83-01027 2F

FLOOD DISCHARGE
Chute Spillway Design Calculations,
W83-00765 8A

FLOOD FORECASTING
Computer-Supported Flood Predictions for the Improvement of flood Protection in the DDR (Rechnergestutzte Hochwasservorhersagen zue Verbesserung des Hochwasserschutzes in der DDR),
W83-00976 2E

FLOODING
Mitigating Drought Through Weather Modification: Selected Institutional and Meteorological Issues in Texas; Volume Four, an Objective Study of the Upper-Air Conditions Relating to Precipitation Over the Southeastern Section of the Edwards Plateau in Texas,
W83-00917 3B

FLOODS
Physical Properties of Great Barrier Reef Lagoon Waters Near Townsville. I. Effects of Burdekin River Floods,
W83-00759 2L

Cyclical Relationships Between River Discharge and Chemical Concentration During Flood Events,
W83-01046 2E

FLORIDA
The Trophic Response of Ciliated Protozoans in Freshwater Lakes,
W83-00704 5C

Long-Term Variation of Macroinvertebrate Assemblages in Apalachee Bay, Florida,
W83-00845 5C

Local Energy Exchanges in a Shallow, Coastal Lagoon: Winter Conditions,
W83-00858 2L

Hydromechanics of Tidal Jets,
W83-00938 2L

FLORIDA AREA CUMULUS EXPERIMENT
Rainfall Results of the Florida Area Cumulus Experiment, 1970-76,
W83-00962 3B

FLOW
Chute Spillway Design Calculations,
W83-00765 8A

FLOW AUGMENTATION
Continuous Withdrawal from Selected Reservoir Strata.
W83-01043 8A

FLOW CONTROL
Design and Construction of Flexible Groynes (Entwurf und bau Flexibler Buhnen),
W83-00974 8B

FLOW MEASUREMENT
A Device for Rapid Measurement of Rate of Flow From Gated Irrigation Pipe,
W83-00839 3F

A Flow-Proportional Sampler for Plot and Lysimeter Studies,
W83-00911 7B

FLUID FLOW
Accuracy of Finite Element Solutions of Navier-Stokes Equations Using a Velocity-Pressure Formulation,
W83-01039 2E

FLUID MECHANICS
Accuracy of Finite Element Solutions of Navier-Stokes Equations Using a Velocity-Pressure Formulation,
W83-01039 2E

Galerkin Finite Element Method and the Groundwater Flow Equation: 1. Convergence of the Method,
W83-01041 2F

FLUORESCENCE
Natural Fluorescence as a Tracer for Distinguishing Between Piedmont and Coastal Plain River Water in the Nearshore Waters of Georgia and North Carolina,
W83-00857 2L

FOG
Clear Water from Coastal Fogs.
W83-00980 3B

FORECASTING
Forecasting Short-Term Revenues for Water and Sewer Utilities,
W83-01042 6D

FOREST MANAGEMENT
Predicting Height and Relative Performance of Major Southern Pines From Rainfall, Slope, and Available Soil Moisture,
W83-00769 2I

FRANCE
C-Band Radar for Determining Surface Soil Moisture,
W83-00735 7B

Physical Characteristics of an Inshore Area on the Atlantic Coast of Brittany and Their Influence on the Pelagic Ecosystem: The Case of the 'Riviere D'Etel',
W83-00792 2L

Dispersive Transfer and Pesticide Propagation in a Submerged Rice-Field (Transferts Dispersifs et Propagation de Pesticides Dans un Sol de Riziere Inondee),
W83-00907 5B

New Method for Tidal Current Computation,
W83-00939 2L

The Use of Bio-Technics in Water Treatment: Feasibility and Performance of Biological Treatment of Nitrates, (In French),
W83-01034 5F

Isotopic Identification of Gases of a Deep Origin in French Thermomineral Waters,
W83-01047 2F

In Situ Determination of the Hydrothermal Properties of a Deep Fractured Medium by a Single-Well Technique,
W83-01049 2F

Information About the Origin of Thermomineral Waters and Gas by Means of Environmental Isotopes in Eastern Azerbaijan, Iran, and Southeast France,
W83-01050 2K

FREQUENCY ANALYSIS
A Method for Estimating the 7-Day, 10-Year Low Flow of Streams in Connecticut,
W83-00991 2E

FREQUENCY DISTRIBUTION
Utility of Frequency Distribution of Moisture Adequacy in the Selection of Crops for Areas With Marginal Rainfall,
W83-00806 3F

FROST HEAVING
Frost Action in Soil Foundations and Control of Surface Structure Heaving,
W83-00919 8D

FUEL
Nature and Hydrocarbon Content of Blooms of the Alga Botryococcus Braunii Occurring in Australian Freshwater Lakes,
W83-00743 2H

FUNGI
The Occurrence of Filamentous Fungi in Drinking Water Distribution Systems,
W83-00849 5F

GAGING STATIONS
Water Resources Programs of the U.S. Geological Survey Related to Agriculture in Louisiana,
W83-01007 7C

GALERKIN METHOD
Galerkin Finite Element Method and the Groundwater Flow Equation: 1. Convergence of the Method,
W83-01041 2F

GAS CHROMATOGRAPHY
Gas Chromatographic Analysis of Trace Hydrocarbon Pollutants in Water Samples,
W83-00800 5A

Determination of Sulphide Ion at Trace Levels by Ethylation and Gas Chromatography,
W83-00805 5A

GEOCHEMISTRY
The Thermal Springs of Bath,
W83-00755 2F

The Significance of Natural Environmental Factors in the Distribution of Copper in Potable Waters of Sri-Lanka,
W83-00798 5B

The Value of Iodide as a Parameter in the Chemical Characterisation of Groundwaters,
W83-00901 2F

GEOLOGIC FRACTURES
Algerian Thermalism in its Geostructural Setting--How Hydrogeology has Helped in the Elucidation of Algeria's Deep-Seated Structure,
W83-00896 2F

GEOLOGY
Hydrogeological Conditions in the Middle East,
W83-00724 2F

Hydrogeology of the Kufra and Sirte Basins, Eastern Libya,
W83-00725 2F

Hydrogeology of the Great Nubian Sandstone Basin, Egypt,
W83-00736 2F

GEOMORPHOLOGY
Hydrogeology of the Syrian Steppe and Adjoining Arid Areas,
W83-00726 2F

Hydrogeology of the Great Nubian Sandstone Basin, Egypt,
W83-00736 2F

GEORGIA
Carbon Isotope Composition of Organic Seston and Sediments in a Georgia Salt Marsh Estuary,
W83-00787 2L

Natural Fluorescence as a Tracer for Distinguishing Between Piedmont and Coastal Plain River Water in the Nearshore Waters of Georgia and North Carolina,
W83-00857 2L

Composition of Modern Stream Sand in a Humid Climate Derived From a Low-Grade Metamorphic and Sedimentary Foreland Fold-Thrust Belt of North Georgia,
W83-00931 2J

GEOTHERMAL RESOURCES
The Thermal Springs of Bath,
W83-00755 2F

Energy Market Impacts of the Legal Definition of Geothermal Energy in the Western United States,
W83-00883 6E

The Los Azufres, Michoacan, Mexico, Geothermal Field,
W83-00903 2F

GEOTHERMAL STUDIES
A Comparison Study for Determining Dissolved Boron in Natural Water and Geothermal Fluid,
W83-00761 5A

Laboratory Measurements of Reservoir Rock From the Geysers Geothermal Field, California,
W83-00770 8E

A New Geothermal Anomaly in Nicaragua,
W83-00895 2F

Algerian Thermalism in its Geostructural Setting--How Hydrogeology has Helped in the Elucidation of Algeria's Deep-Seated Structure,
W83-00896 2F

A Layered Thermal-Water Twin Flow System,
W83-00906 2F

Isotopic Identification of Gases of a Deep Origin in French Thermomineral Waters,
W83-01047 2F

In Situ Determination of the Hydrothermal Properties of a Deep Fractured Medium by a Single-Well Technique,
W83-01049 2F

Information About the Origin of Thermomineral Waters and Gas by Means of Environmental Isotopes in Eastern Azerbaijan, Iran, and Southeast France,
W83-01050 2K

GERMAN DEMOCRATIC REPUBLIC
Microelectronics - A Decisive Medium for the Realization of Automatic Telemetry Networks for Water Monitoring (Die Mikroelektronik - ein Entscheidendes Mittel bei der Realisierung Automatischer Fermnessnetze zue Gewasseruberwachung),
W83-00975 7A

Expanded Criteria for the Assessment of Water Quality in running Waters (Erweiterte Kriterien zue Beurteilung der Wasserbeschaffenheit in Fliessgewassern),
W83-00977 6F

Determination of Geohydraulic Parameters and the Infiltration Capacity of Sand Basins for Artificial Groundwater Enrichment (Bestimmung der Geohydraulischen Parameter und der Infiltrationsleistung von Sandbecken bei Kunstlicher Grundwasseranreicherung),
W83-00983 5G

GIBBERELLIC ACID
Synergistic Effect of Gibberellic Acid and Chlorflurenol on 2,4-D With Regard to Water Hyacinth,
W83-00745 4A

GIBBS EQUATION
The Applicability of the Gibbs Euation for Grain Settling Velocities to Conditions Other Than Quartz Grains in Water,
W83-00930 2J

GLACIERS
Calculations on a Model for the Future Behaviour of Griesgletscher, Wallis (Modellrechnungen zum Zukunftigen Verhalten des Griesgletschers, Wallis),
W83-00982 2C

GLUCOSE
Diurnal Change of 14C-Glucose Uptake by Epilimnetic Microbes in Lake Kizaki,
W83-00715 2H

GOVERNMENTAL INTERRELATIONS
Mitigating Drought Through Weather Modification: Selected Institutional and Meteorological Issues in Texas; Volume One, Texas Advisory Commission on Intergovernmental Relations,
W83-00914 3B

GRAVEL
Construction, Operation and Maintenance of Gravel Wells,
W83-00966 8A

GRAZING
Interactions Between Suspended Organic Matter and Copepod Grazing in the Plume of the Hudson River,
W83-00793 2L

GREAT BARRIER REEF
Physical Properties of Great Barrier Reef Lagoon Waters Near Townsville. I. Effects of Burdekin River Floods,
W83-00759 2L

GREENHOUSES
Economics of the Water Blanket Technique for Greenhouse Heating,
W83-00762 3C

GROINS
Design and Construction of Flexible Groynes (Entwurf und bau Flexibler Buhnen),
W83-00974 8B

GROUNDWATER
The Importance of Groundwater in the Transportation of Allochthonous Dissolved Organic Matter to the Streams Draining a Small Mountain Basin,
W83-00710 2F

The Value of Iodide as a Parameter in the Chemical Characterisation of Groundwaters,
W83-00901 2F

Determination of Geohydraulic Parameters and the Infiltration Capacity of Sand Basins for Artificial Groundwater Enrichment (Bestimmung der Geohydraulischen Parameter und der Infiltrationsleistung von Sandbecken bei Kunstlicher Grundwasseranreicherung),
W83-00983 5G

Sulfur Isotopic Composition and Water Chemistry in Water from the High Plains Aquifer, Oklahoma Panhandle and Southwestern Kansas,
W83-00987 2F

Water Resources Data, Idaho, Water Year 1981--Volume 2. Upper Columbia River Basin and Snake River Basin Below King Hill.
W83-00993 7C

Water Resources Data, Michigan, Water Year 1981.
W83-00994 7C

Water Resources Data, Colorado, Water Year 1981--Volume 1. Missouri River Basin, Arkansas River Basin, and Rio Grande Basin.
W83-00995 7C

Water Resources Data, Colorado, Water Year 1981--Volume 2. Colorado River Basin Above Dolores River.
W83-00996 7C

Water Resources Data, Pennsylvania, Water Year 1981--Volume 3. Ohio River and St. Lawrence River Basin.
W83-00997 7C

Water Resources Data, Pennsylvania, Water Year 1981--Volume 2. Susquehanna and Potomac River Basins.
W83-00998 7C

Water Resources Data, South Dakota, Water Year 1981.
W83-00999 7C

Water Resources Data, Ohio, Water Year 1981--Volume 1. Ohio River Basin.
W83-01000 7C

Water Resources Data, Ohio, Water Year 1981--Volume 2. St. Lawrence River Basin Statewide Project Data.
W83-01001 7C

Water Resources Data, Montana, Water Year 1981--Volume 2. Columbia River Basin.
W83-01002 7C

Water Resources Data, Idaho, Water Year 1981--Volume 1. Great Basin and Snake River Basin above King Hill,
W83-01003 7C

Groundwater Levels in Nebraska, 1981,
W83-01004 2F

Water-Quality Assessment of the Smith River Drainage Basin, California and Oregon.
W83-01006 7C

GROUNDWATER DEPLETION

Water-Level Trends, Pumpage, and Chemical Quality in the Cambrian-Ordovician Aquifer in Illinois, 1971-1980,
W83-00947 6D

GROUNDWATER LEVEL

Effect of an Ephemeral Stream on the Groundwater Level and Groundwater Quality in an Arid Zone of India,
W83-00897 4B

Hydraulic Properties of a Major Alluvial Aquifer: An Isotropic, Inhomogeneous System--Reply,
W83-00898 2F

Hydraulic Properties of a Major Alluval Aquifer: An Isotropic, Inhomogeneous System--Comments,
W83-00899 2F

GROUNDWATER MANAGEMENT

Effect of an Ephemeral Stream on the Groundwater Level and Groundwater Quality in an Arid Zone of India,
W83-00897 4B

Vulnerability Maps: A Promising Tool in Groundwater Protection,
W83-01012 5G

Groundwater Management with Process Computers in the Hardhof Groundwater Plant of Zurich Water Supply,
W83-01014 4B

GROUNDWATER MOVEMENT

A Layered Thermal-Water Twin Flow System,
W83-00906 2F

Determining the Turnover Time of Groundwater Systems With the Aid of Environmental Tracers. 1. Models and Their Applicability,
W83-00908 2F

Sulfur Isotopic Composition and Water Chemistry in Water from the High Plains Aquifer, Oklahoma Panhandle and Southwestern Kansas,
W83-00987 2F

Galerkin Finite Element Method and the Groundwater Flow Equation: 1. Convergence of the Method,
W83-01041 2F

GROWTH STAGES

Moisture-Sensitive Growth Stages of Dwarf Wheat and Optimal Sequencing of Evapotranspiration Deficits,
W83-00834 3F

Water Deficit Effects on Water Potential, and Water Use of Cowpeas,
W83-00835 2I

Drought Sensitivity at Various Growth Stages of Barley in Relation to Relative Evapotranspiration and Water Stress,
W83-00838 3F

Effects of Repeated Application of Water Stress on Water Status and Growth of Wheat,
W83-00875 2I

HEAT BUDGET

Local Energy Exchanges in a Shallow, Coastal Lagoon: Winter Conditions,
W83-00858 2L

HEAT EXCHANGE

On the Heat Exchange Between Rivers and Atmosphere,
W83-00752 2A

In Situ Determination of the Hydrothermal Properties of a Deep Fractured Medium by a Single-Well Technique,
W83-01049 2F

HEAT FLOW

A New Geothermal Anomaly in Nicaragua,
W83-00895 2F

HEAT TRANSFER

A Physical Model Study of the Storage of Low-Grade Heat in Unsaturated Chalk,
W83-00904 4B

HEATED WATER

The Thermal Springs of Bath,
W83-00755 2F

Economics of the Water Blanket Technique for Greenhouse Heating,
W83-00762 3C

HEAVY METALS

Ecology of the Forest Stream Lane Bloto in the Niepolomice Forest 1. Chemism of Water and Bottom Sediments and its Changes Under the Influence of Industrial Pollution,
W83-00763 5B

Copper, Zinc, and Cadmium Concentrations of Resident Trout Related to Acid-Mine Wastes,
W83-00862 5B

Estuarine Metal Monitoring in Southern Brazil,
W83-00880 5B

Heavy Metals Pollution of the Upper Arkansas River, Colorado, and its Effects on the Distribution of the Aquatic Macrofauna,
W83-00921 5C

HERBICIDES

Aggregates of Particulate Matter and Aufwuchs on Elodea Canadensis in Irrigation Waters, and Inactivation of Diquat,
W83-00741 4A

Maize Culture in Reed Canarygrass Sod to Renovate Municipal Wastewater Effluent,
W83-01024 3C

HETEROTROPHIC BACTERIA

Attached and Free-Floating Bacteria in the Fraser River Estuary, British Columbia, Canada,
W83-00879 2L

HIGHWAYS

Titanium and Tungsten in Highway Runoff at Pullman, Washington,
W83-00799 5B

Hydrologic Effects of Highway-Deicing Chemicals in Massachusetts--Executive Summary,
W83-01008 4C

HUDSON RIVER

Copepod Communities in the Estuary and Coastal Plume of the Hudson River,
W83-00813 2L

HUMIC CLIMATES

Composition of Modern Stream Sand in a Humid Climate Derived From a Low-Grade Metamorphic and Sedimentary Foreland Fold-Thrust Belt of North Georgia,
W83-00931 2J

HUNGARY

A Layered Thermal-Water Twin Flow System,
W83-00906 2F

HYDRAULIC DESIGN

Hydraulic Model Study of Ute Dam Labyrinth Spillway,
W83-00920 8B

HYDRAULIC MODELS

Hydraulic Model Study of Choke Canyon Dam Spillway and Stilling Basin,
W83-00918 8A

HYDRAULIC STRUCTURES

Frost Action in Soil Foundations and Control of Surface Structure Heaving,
W83-00919 8D

HYDRILLA

Influence of Potassium Source (Sediment Vs. Open Water) and Sediment Composition on the Growth and Nutrition of a Submersed Freshwater Macrophyte (Hydrilla Verticillata (L.F.)
W83-00830 2I

HYDROCARBONS

Nature and Hydrocarbon Content of Blooms of the Alga Botryococcus Braunii Occurring in Australian Freshwater Lakes,
W83-00743 2H

Gas Chromatographic Analysis of Trace Hydrocarbon Pollutants in Water Samples,
W83-00800 5A

Aquatic Distribution and Heterotrophic Degradation of Polycyclic Aromatic Hydrocarbons (PAH) in the Tamar Estuary,
W83-00808 5B

HYDRODYNAMICS

Howe Lake: A Hydrodynamic Blowout Structure,
W83-00847 2H

HYDROELECTRIC PLANTS

Report on Assessment of Low-Head Hydroelectric Sites in the Western States; Methology and Summary.
W83-00922 6C

Appendix to Report on Assessment of Low-Head Hydroelectric Sites in the Western States; Evaluation Reports for Low-Head Hydroelectric Sites, Part I - California.
W83-00923 8A

Appendix to Report on Assessment of Low-Head Hydroelectric Sites in the Western State; Evaluation Reports for Low-Head Hydroelectric Sites, Part II - Colorado.
W83-00924 8A

Appendix to Report on Assessment of Low-Head Hydroelectric Sites in the Western States; Evaluation Reports for Low-Head Hydroelectric Sites, Part III - Idaho and Utah.
W83-00925 8A

Appendix to Report of Assessment of Low-Head Hydroelectric Sites in the Western States;

HYDROELECTRIC PLANTS

Evaluation Reports for Low-Head Hydroelectric Sites, Part IV - Kansas, New Mexico, Oklahoma, and Texas.
W83-00926 8A

Appendix to Report on Assessment of Low-Head Hydroelectric Sites in the Western States; Evaluation Reports for Low-Head Hydroelectric Sites, Part V - Montana and Wyoming.
W83-00927 8A

Appendix to Report on Assessment of Low-Head Hydroelectric Sites in the Western States; Evaluation Reports for Low-Head Hydroelectric Sites, Part VI - Oregon and Washington.
W83-00928 8A

HYDROGEN ION CONCENTRATION

High Resolution Vertical Profiles of pH in Recent Sediments,
W83-00729 5B

HYDROGEOLOGY

Hydrogeology of the Syrian Steppe and Adjoining Arid Areas,
W83-00726 2F

Hydrogeology of the Umm Er Radhuma Aquifer, Saudi Arabia, With Reference to Fossil Gradients,
W83-00727 2F

HYDROLOGIC DATA

Water Resources Data, Idaho, Water Year 1981--Volume 2. Upper Columbia River Basin and Snake River Basin Below King Hill.
W83-00993 7C

Water Resources Data, Michigan, Water Year 1981.
W83-00994 7C

Water Resources Data, Colorado, Water Year 1981--Volume 1. Missouri River Basin, Arkansas River Basin, and Rio Grande Basin.
W83-00995 7C

Water Resources Data, Colorado, Water Year 1981--Volume 2. Colorado River Basin Above Dolores River.
W83-00996 7C

Water Resources Data, Pennsylvania, Water Year 1981--Volume 3. Ohio River and St. Lawrence River Basin.
W83-00997 7C

Water Resources Data, Pennsylvania, Water Year 1981--Volume 2. Susquehanna and Potomac River Basins.
W83-00998 7C

Water Resources Data, South Dakota, Water Year 1981.
W83-00999 7C

Water Resources Data, Ohio, Water Year 1981--Volume 1. Ohio River Basin.
W83-01000 7C

Water Resources Data, Ohio, Water Year 1981--Volume 2. St. Lawrence River Basin Statewide Project Data.
W83-01001 7C

Water Resources Data, Montana, Water Year 1981--Volume 2. Columbia River Basin.
W83-01002 7C

Water Resources Data, Idaho, Water Year 1981--Volume 1. Great Basin and Snake River Basin above King Hill,
W83-01003 7C

Water-Quality Assessment of the Smith River Drainage Basin, California and Oregon.
W83-01006 7C

HYDROLOGIC MODELS

A Lumped-Parameter Model for Infiltration,
W83-00913 2G

Numerical Modeling of Salt-Water Intrusion in the Northern Guam Lens,
W83-00946 4B

Time of Concentration and Storage Coefficient Values for Illinois Streams,
W83-00986 2A

A Technique for Estimating Time of Concentration and Storage Coefficient Values for Illinois Streams,
W83-00988 2A

HYDROLOGY

Hydrology of the Prairie Dog Creek Drainage Basin, Rosebud and Big Horn Counties, Montana,
W83-00990 7C

HYDROSTATIC PRESSURE

The Meaning of Matric Potential,
W83-00964 2I

HYDRUALIC ENGINEERING

Design and Construction of Flexible Groynes (Entwurf und bau Flexibler Buhnen),
W83-00974 8B

HYPOLIMNION

Electron Flow Via Sulfate Reduction and Methanogenesis in the Anaerobic Hypolimnion of Lake Mendota,
W83-00877 2H

ICE

Reconstruction of Past Ice Conditions in a Hudson Bay Estuary Using Tree Rings,
W83-00766 2C

Formation of Ice Crystals and Dissipation of Supercooled Fog by Artificial Nucleation, and Variations of Crystal Habit at Early Growth Stages,
W83-00949 3B

ICE THICKNESS

Aircraft Measurements of Icing in Supercooled and Water Droplet Ice Crystal Clouds,
W83-00948 3B

IDAHO

Low-Level Aerial Infrared Images for Inventory of an Irrigated Area,
W83-00733 7B

Appendix to Report on Assessment of Low-Head Hydroelectric Sites in the Western States; Evaluation Reports for Low-Head Hydroelectric Sites, Part III - Idaho and Utah.
W83-00925 8A

Water Resources Data, Idaho, Water Year 1981--Volume 2. Upper Columbia River Basin and Snake River Basin Below King Hill.
W83-00993 7C

Water Resources Data, Idaho, Water Year 1981--Volume 1. Great Basin and Snake River Basin above King Hill,
W83-01003 7C

ILLINOIS

Combined Treatment Plant Handles City and Paperboard Mill Effluent,
W83-00893 5D

Sedimentology of Muddy Fine-Grained Channel Deposits in Meandering Streams of the American Middle West,
W83-00933 2J

Water-Level Trends, Pumpage, and Chemical Quality in the Cambrian-Ordovician Aquifer in Illinois, 1971-1980,
W83-00947 6D

Time of Concentration and Storage Coefficient Values for Illinois Streams,
W83-00986 2A

A Technique for Estimating Time of Concentration and Storage Coefficient Values for Illinois Streams,
W83-00988 2A

IMPINGEMENT

Use of Conventional Fishery Models to Assess Entrainment and Impingement of Three Lake Michigan Fish Species,
W83-00891 8I

INCOME

Forecasting Short-Term Revenues for Water and Sewer Utilities,
W83-01042 6D

INDIA

Changes in the Environmental Pollution in the Calcutta-Hooghlyside Industrial Strip of India,
W83-00801 5B

Trace Metal Content in the Lalbag Pond of Baroda City Near the Highway,
W83-00803 5B

Environmental Characteristics of the Mandovi-Zuari Estuarine System in Goa,
W83-00804 2L

Utility of Frequency Distribution of Moisture Adequacy in the Selection of Crops for Areas With Marginal Rainfall,
W83-00806 3F

Moisture-Sensitive Growth Stages of Dwarf Wheat and Optimal Sequencing of Evapotranspiration Deficits,
W83-00834 3F

Algal Dynamics in Relation to Physico-Chemical Factors in a High Altitude Pond of Shillong, India,
W83-00853 2H

Primary Productivity in Relation to the Abiotic Factors in a Temporary Freshwater Pond,
W83-00854 2H

A Field Study of Estuarine Pollution in Madras, India,
W83-00881 5B

Effect of an Ephemeral Stream on the Groundwater Level and Groundwater Quality in an Arid Zone of India,
W83-00897 4B

A Nonlinear Optimisation Method for Aquifer Parameter Estimation.
W83-00905 2F

Stochastic Modelling of Monthly Rainfall,
W83-00910 2B

Water Deficiency in Dharwad District,
W83-01022 2B

Quality of Underground Irrigation Waters in Semi-Arid Tract of District Agra. III. Tehsils Bay and Fatehabad,
W83-01023 2K

INDIANA

Sedimentology of Muddy Fine-Grained Channel Deposits in Meandering Streams of the American Middle West,
W83-00933 2J

INDUSTRIAL WASTES

Changes in the Environmental Pollution in the Calcutta-Hooghlyside Industrial Strip of India,
W83-00801 5B

Combined Treatment Plant Handles City and Paperboard Mill Effluent,
W83-00893 5D

Open Ocean Disposal of Materials Dredged from a Highly Industrialized Estuary: An Evaluation of Potential Lethal Effects,
W83-01030 5E

INDUSTRIAL WASTEWATER
Spectrophotometric Determination of Microgram Amounts of Chromium(VI) and Total Chromium in Waste Water,
W83-00768 5A

INFILTRATION
The Three-Parameter Infiltration Equation,
W83-00734 2G

Dispersive Transfer and Pesticide Propagation in a Submerged Rice-Field (Transferts Dispersifs et Propagation de Pesticides Dans un Sol de Riziere Inondee),
W83-00907 5B

A Lumped-Parameter Model for Infiltration,
W83-00913 2G

Impact of Incremental Surface Soil Depths on Infiltrations Rates, Potential Sediment Losses, and Chemical Water Quality,
W83-00934 2J

Maize Culture in Reed Canarygrass Sod to Renovate Municipal Wastewater Effluent,
W83-01024 3C

Evaluating Infiltration for Border Irrigation Models,
W83-01026 3F

Free Surface and Saturated-Unsaturated Analyses of Borehole Infiltration Tests Above the Water Table,
W83-01038 2G

INFILTRATION CAPACITY
Determination of Geohydraulic Parameters and the Infiltration Capacity of Sand Basins for Artificial Groundwater Enrichment (Bestimmung der Geohydraulischen Parameter und der Infiltrationsleistung von Sandbecken bei Kunstlicher Grundwasseranreicherung),
W83-00983 5G

INFRARED IMAGERY
Low-Level Aerial Infrared Images for Inventory of an Irrigated Area,
W83-00733 7B

INHIBITORS
How Inhibitors Improve Economics of Scale,
W83-00970 8G

INJECTION
Laboratory Measurements of Reservoir Rock From the Geysers Geothermal Field, California,
W83-00770 8E

INJECTION WELLS
In Situ Determination of the Hydrothermal Properties of a Deep Fractured Medium by a Single-Well Technique,
W83-01049 2F

INLAND WATERWAYS
Changes in Quality of Finnish Inland Waters Revealed by Grouping Analysis,
W83-00791 2H

INLETS
Ebb-Tidal Flow Characteristics Near Inlets,
W83-00859 2L

INTAKES
Continuous Withdrawal from Selected Reservoir Strata.
W83-01043 8A

INTERMITTENT STREAMS
The Physico-Chemical Hydrology of a Tropical Seasonal River-Upper Ogun River,
W83-00706 2E

INTERNATIONAL COMMISSIONS
ECE Seminar on Water Utilization Recommends Giving Water Management Policies High Priority.
W83-00796 6D

ECE Water Committee Recommends Declaration on Water Pollution.
W83-00797 5G

INVERTEBRATES
Invertebrate Fauna and Ecology of Temporary Pools on Granite Outcrops in Southern Western Australia,
W83-00740 2H

IODIDES
The Value of Iodide as a Parameter in the Chemical Characterisation of Groundwaters,
W83-00901 2F

ION EXCHANGE
Water Decontamination Process Improvement Tests and Considerations,
W83-01037 5D

ION STUDIES
Free Nickel Ion Concentration in Sewage by an Ion Exchange Column-Equilibration Method,
W83-00842 5A

IONIC STUDIES
Estimation of Multiple Inflows to a Stream Reach Using Water Chemistry Data,
W83-00722 2E

IONS
Examination and Evaluation of Biological Degrading of Metal Gluconate Complexes through the Zahn/Wallens Batch Method (Prufung und Bewertung der Biologischen Abbaubarkeit von me Gluconatkomplexen im Standversuch nach Zahn/Wellens),
W83-00972 5D

IRAN
Information About the Origin of Thermomineral Waters and Gas by Means of Environmental Isotopes in Eastern Azerbaijan, Iran, and Southeast France,
W83-01050 2K

IRON OXIDES
Formation of Freshwater Fe-Mn Coatings on Gravel and the Behavior of Co60, Sr90, and Cs137 in a Small Watershed,
W83-00788 5B

IRRADIATION
Estimation of the Scattering Coefficient of Natural Waters Using Underwater Irradiance Measurements,
W83-00744 1A

IRRIGATION
Low-Level Aerial Infrared Images for Inventory of an Irrigated Area,
W83-00733 7B

On the Introduction of Phytophagous Fishes into Gravity-Flow Irrigation Systems in the Sudan,
W83-00783 4A

Influence of Irrigation of the Development and Yield of Potatoes,
W83-00833 3F

A Device for Rapid Measurement of Rate of Flow From Gated Irrigation Pipe,
W83-00839 3F

Water Type and Suitability of Oklahoma Surface Waters for Public Supply and Irrigation. Part 2: Salt Fork Arkansas River and Cimarron River Basins Through 1978,
W83-00989 7C

IRRIGATION EFFICIENCY
Comparison of Sprinkler, Trickle, Subsurface, and Furrow Irrigation Methods for Row Crops,
W83-00840 3F

IRRIGATION PATTERNS
Irrigation Scheduling Using Crop Canopy-Air Temperature Difference,
W83-00887 3F

IRRIGATION PRACTICES
Drainage of an Irrigated Saline Soil in Alberta,
W83-00850 4A

IRRIGATION REQUIREMENTS
Moisture-Sensitive Growth Stages of Dwarf Wheat and Optimal Sequencing of Evapotranspiration Deficits,
W83-00834 3F

Water Deficit Effects on Water Potential, and Water Use of Cowpeas,
W83-00835 2I

Yield of Alfalfa and Cotton as Influenced by Irrigation,
W83-00836 3F

IRRIGATION SCHEDULING
Irrigation Scheduling Using Crop Canopy-Air Temperature Difference,
W83-00887 3F

IRRIGATION WATER
Effects of Repeated Application of Water Stress on Water Status and Growth of Wheat,
W83-00875 2I

Quality of Underground Irrigation Waters in Semi-Arid Tract of District Agra. III. Tehsils Bay and Fatehabad,
W83-01023 2K

ISOTOPE STUDIES
Sulfur Isotopic Composition and Water Chemistry in Water from the High Plains Aquifer, Oklahoma Panhandle and Southwestern Kansas,
W83-00987 2F

Isotopic Identification of Gases of a Deep Origin in French Thermomineral Waters,
W83-01047 2F

Information About the Origin of Thermomineral Waters and Gas by Means of Environmental Isotopes in Eastern Azerbaijan, Iran, and Southeast France,
W83-01050 2K

ITALY
Ciliated Protozoa and Water Quality in the Torrente Stirone (Northern Italy),
W83-00749 5C

JAPAN
In Situ Growth and Photosynthetic Characteristics of Oscillatoria Mougeotii in the Metalimnetic Layer of the Small Eutrophic Lake Nakanuma,
W83-00714 2H

Diurnal Change of 14C-Glucose Uptake by Epilimnetic Microbes in Lake Kizaki,
W83-00715 2H

Salinity Levels and Water Exchange in Gamo Lagoon,
W83-00716 2L

Vertical Distribution of Free-Living and Attached Heterotrophic Bacteria in Lake Kizaki,
W83-00718 2H

Distribution of Heavy Metals in Bottom Mud of Rivers VIII. Distribution of Total and Extractable Cd and Zn,
W83-00719 5B

Studies on the Decompositive Processes of Phytoplanktonic Organic Matter,
W83-00720 2H

The Distribution of Urea in Lake Yunoko,
W83-00721 5B

Vertical Distribution of 137-CS and its Accumulation Rate in Lake Sediments,
W83-00780 2J

Bacterial Flora of the Water and Sediment in the Edo River Mouth (In Japanese),
W83-00781 5C

KANSAS
Appendix to Report of Assessment of Low-Head Hydroelectric Sites in the Western States; Evaluation Reports for Low-Head Hydroelectric Sites, Part IV - Kansas, New Mexico, Oklahoma, and Texas.
W83-00926 8A

Sulfur Isotopic Composition and Water Chemistry in Water from the High Plains Aquifer, Oklahoma Panhandle and Southwestern Kansas,
W83-00987 2F

KINETICS
Studies on the Decompositive Processes of Phytoplanktonic Organic Matter,
W83-00720 2H

The Uptake of Phosphate by Carex Species for Oligotrophic to Eutrophic Swamp Habitats,
W83-00874 5B

LABYRINTH SPILLWAYS
Hydraulic Model Study of Ute Dam Labyrinth Spillway,
W83-00920 8B

LAGOONS
Salinity Levels and Water Exchange in Gamo Lagoon,
W83-00716 2L

Physical Properties of Great Barrier Reef Lagoon Waters Near Townsville. I. Effects of Burdekin River Floods,
W83-00759 2L

LAKE EVAPORATION
The Significance of Surface Temperature Patterns on the Energy Balance of a Small Lake in the Canadian Shield,
W83-01029 2H

LAKE MENDOTA
Electron Flow Via Sulfate Reduction and Methanogenesis in the Anaerobic Hypolimnion of Lake Mendota,
W83-00877 2H

LAKE MICHIGAN
Use of Conventional Fishery Models to Assess Entrainment and Impingement of Three Lake Michigan Fish Species,
W83-00891 8I

LAKE ONTARIO
Lake Ontario Atmospheric Deposition, 1969-1978,
W83-00954 5B

LAKE RESTORATION
Shallow Dredging as a Strategy for the Control of Sublittoral Macrophytes: A Case Study in Tuggerah Lakes, New South Wales,
W83-00831 5G

The Feasibility and Benefits of Reclaiming a Man-Made Lake: A Case Study of Lake Paradise, Mattoon, Illinois,
W83-00945 6B

Liming of Acidified Lakes: Induced Long-Term Changes,
W83-00958 5G

Structure and Productivity of Epiphytic Algal Communities on Lobelia Dortmanna L. in Acidified and Limed Lakes,
W83-00959 5G

LAKE SEDIMENTS
Records of a Lakes' Life in Time: The Sediments,
W83-00708 5C

Total Organic Carbon in Lake Superior Sediments: Comparisons With Hemipelagic and Pelagic Marine Environments,
W83-00878 2H

The Feasibility and Benefits of Reclaiming a Man-Made Lake: A Case Study of Lake Paradise, Mattoon, Illinois,
W83-00945 6B

Acidification of Nova Scotia Lakes I: Response of Diatom Assemblages in the Halifax Area,
W83-00960 5C

LAKE SUPERIOR
Total Organic Carbon in Lake Superior Sediments: Comparisons With Hemipelagic and Pelagic Marine Environments,
W83-00878 2H

Measurement of Snow Water Storage in the Lake Superior Basin Using Aerial Gamma-Ray Spectrometry,
W83-00965 7B

LAKE TANEYCOMO
Socioeconomic Value of the Trout Fishery in Lake Taneycomo, Missouri,
W83-00872 6C

LAKE WASHINGTON
Daphnia in Lake Washington,
W83-00703 2H

LAKES
The Trophic Response of Ciliated Protozoans in Freshwater Lakes,
W83-00704 5C

Phytoplankton Ecology of the Lake of Menteith, Scotland,
W83-00711 2H

In Situ Growth and Photosynthetic Characteristics of Oscillatoria Mougeotii in the Metalimnetic Layer of the Small Eutrophic Lake Nakanuma,
W83-00714 2H

Vertical Distribution of Free-Living and Attached Heterotrophic Bacteria in Lake Kizaki,
W83-00718 2H

The Distribution of Urea in Lake Yunoko,
W83-00721 5B

A Study of the Benthic Communities of Twenty Lakes in the South Island, New Zealand,
W83-00737 2H

Nutrients and Phytoplankton in Three Shallow, Fresh-water Lakes of Different Trophic Status in Western Australia,
W83-00739 5C

Limnology of Perched Lake, South-West Tasmania,
W83-00742 2H

Pathway and Distribution of Trace Elements in Lake Vanda, Antarctica,
W83-00756 5B

Primary Production in Three Lakes of Differing Salinity in Victoria, Australia,
W83-00775 2H

The Phosphorus Economy of a Hypertrophic Seepage Lake in Scania, South Sweden Groundwater Influence,
W83-00777 2H

Vertical Distribution of 137-CS and its Accumulation Rate in Lake Sediments,
W83-00780 2J

Goals, Methods and Possibilities for Directing Development of Limnic Ecosystems,
W83-00790 5G

Limnology of a Eutrophic Reservoir: Big Bear Lake, California,
W83-00846 5C

Howe Lake: A Hydrodynamic Blowout Structure,
W83-00847 2H

Electron Flow Via Sulfate Reduction and Methanogenesis in the Anaerobic Hypolimnion of Lake Mendota,
W83-00877 2H

Lake Ontario Atmospheric Deposition, 1969-1978,
W83-00954 5B

Biological, Chemical and Physical Responses of Lakes to Experimental Acidification,
W83-00957 5C

Structure and Productivity of Epiphytic Algal Communities on Lobelia Dortmanna L. in Acidified and Limed Lakes,
W83-00959 5G

Acidification of Nova Scotia Lakes I: Response of Diatom Assemblages in the Halifax Area,
W83-00960 5C

Limnology of Shallow Lakes and Reservoirs (Limnologie Flacher Seen und Talsperren),
W83-00981 2H

The Significance of Surface Temperature Patterns on the Energy Balance of a Small Lake in the Canadian Shield,
W83-01029 2H

Finite Element Analysis of Horizontal and Vertical Turbulent Diffusion Problems in Lakes,
W83-01040 2H

LAND RECLAMATION
Creation of Wetland Habitats in Northeastern Illinois,
W83-00944 5G

LAND USE
Streamflow Information for Connecticut with Applications to Land-Use Planning,
W83-00992 3E

LAPLACE EQUATION
Laplace Transform Solutions for Solute Transport in Fissured Aquifers,
W83-01027 2F

LEACHING
Design and Testing of a New Microlysimeter for Leaching Studies,
W83-00821 7B

Modern and Paleolimnological Evidence for Accelerated Leaching and Metal Accumulation in Soils in New England, Caused by Atmospheric Deposition,
W83-00956 5B

LEAD
Trace Metal Content in the Lalbag Pond of Baroda City Near the Highway,
W83-00803 5B

LEAVES
Modeling Soybean Leaf-Water Potentials Under Nonlimiting Soil Water Conditions,
W83-00824 2I

LEGAL ASPECTS
Reducing the Cost of Water Pollution Control Under the Clean Water Act,
W83-00757 6E

Federal Non-Reserved Water Rights: Fact or Fiction.,
W83-00767 6E

The Development of the Salt Problem in the Rhine in the 60's and 70's (Die Entwicklung des Salz-Problems am Rhein in den 60er und 70er Jahren).
W83-00785 5G

The Availability of Private Remedies for Acid Rain Damage,
W83-00794 6E

Energy Market Impacts of the Legal Definition of Geothermal Energy in the Western United States,
W83-00883 6E

Mitigating Drought Through Weather Modification: Selected Institutional and Meteorological Issues in Texas; Volume One, Texas Advisory Commission on Intergovernmental Relations,
W83-00914 3B

LEGISLATION
The Politics of Water Pollution Control: A Case Study of the Canadian Fisheries Act Amendments and the Pulp and Paper Effluent Regulations, 1970,
W83-00951 6E

LIBYA
Hydrogeology of the Kufra and Sirte Basins, Eastern Libya,
W83-00725 2F

LIGHT INTENSITY
Effect of Light Intensity of Sulfate Uptake and Primary Productivity by Natural Freshwater Microplankton Communities and Axenic Algal Cultures,
W83-00778 2H

LIGHT PENETRATION
Estimation of the Scattering Coefficient of Natural Waters Using Underwater Irradiance Measurements,
W83-00744 1A

Monte Carlo Study of the Nature of the Underwater Light Field in, and the Relationships Between Optical Properties of, Turbid Yellow Waters,
W83-01011 2H

LIME
Liming of Acidified Lakes: Induced Long-Term Changes,
W83-00958 5G

Structure and Productivity of Epiphytic Algal Communities on Lobelia Dortmanna L. in Acidified and Limed Lakes,
W83-00959 5G

LIMITING NUTRIENTS
Concepts for the Modelling of the Phosphorus Cycle in Lakes and Reservoirs (Modellvorstellungen uber den Phosphorkreislauf in Stehenden Gewassern),
W83-00971 5C

LIMNOLOGY
Records of a Lakes' Life in Time: The Sediments,
W83-00708 5C

Limnology of Perched Lake, South-West Tasmania,
W83-00742 2H

Limnology of Heart Lake, Ontario,
W83-00774 2H

The Phosphorus Economy of a Hypertrophic Seepage Lake in Scania, South Sweden Groundwater Influence,
W83-00777 2H

Goals, Methods and Possibilities for Directing Development of Limnic Ecosystems,
W83-00790 5G

Limnology of a Eutrophic Reservoir: Big Bear Lake, California,
W83-00846 5C

The Relation Between Fisheries Management and Limnology,
W83-00873 5C

Limnology of Shallow Lakes and Reservoirs (Limnologie Flacher Seen und Talsperren),
W83-00981 2H

LITERATURE REVIEW
Activated Sludge,
W83-00943 5D

LITERATURE REVIEWS
A Review of Rainwater Harvesting,
W83-01025 3B

LOUISIANA
Water Resources Programs of the U.S. Geological Survey Related to Agriculture in Louisiana,
W83-01007 7C

LOW FLOW
A Method for Estimating the 7-Day, 10-Year Low Flow of Streams in Connecticut,
W83-00991 2E

LOW HEAD
Report on Assessment of Low-Head Hydroelectric Sites in the Western States; Methology and Summary.
W83-00922 6C

Appendix to Report on Assessment of Low-Head Hydroelectric Sites in the Western States; Evaluation Reports for Low-Head Hydroelectric Sites, Part I - California.
W83-00923 8A

Appendix to Report on Assessment of Low-Head Hydroelectric Sites in the Western State; Evaluation Reports for Low-Head Hydroelectric Sites, Part II - Colorado.
W83-00924 8A

Appendix to Report on Assessment of Low-Head Hydroelectric Sites in the Western States; Evaluation Reports for Low-Head Hydroelectric Sites, Part III - Idaho and Utah.
W83-00925 8A

Appendix to Report of Assessment of Low-Head Hydroelectric Sites in the Western States; Evaluation Reports for Low-Head Hydroelectric Sites, Part IV - Kansas, New Mexico, Oklahoma, and Texas.
W83-00926 8A

Appendix to Report on Assessment of Low-Head Hydroelectric Sites in the Western States; Evaluation Reports for Low-Head Hydroelectric Sites, Part V - Montana and Wyoming.
W83-00927 8A

Appendix to Report on Assessment of Low-Head Hydroelectric Sites in the Western States; Evaluation Reports for Low-Head Hydroelectric Sites, Part VI - Oregon and Washington.
W83-00928 8A

LYSIMETERS
Design and Testing of a New Microlysimeter for Leaching Studies,
W83-00821 7B

Design and Testing of a Microlysimeter for Wetland Rice,
W83-00826 2D

Evapotranspiration Studies on Rice in Relation to Water Use Efficiency,
W83-00868 3F

MACHROPHYTES
Oxygen Concentrations and Elimination of Inorganic Phosphorus and Nitrogen in an Experimental Watercourse Stocked With Emergent Macrophytes,
W83-00843 5D

MACROINVERTEBRATES
Long-Term Variation of Macroinvertebrate Assemblages in Apalachee Bay, Florida,
W83-00845 5C

Effects of Experimental Acidification on Macroinvertebrate Drift Diversity in a Mountain Stream,
W83-00967 5C

MACROPHYTES
Status of Aquatic Macrophytes in an Undrained Area of Fen in the Norfolk Broads, England,
W83-00746 5C

Application of Multiple Discriminant Analysis on the Analysis of the Correlation Between Macrophyte Vegetation and Water Quality in Running Waters of Central Europe,
W83-00776 5A

Influence of Potassium Source (Sediment Vs. Open Water) and Sediment Composition on the Growth and Nutrition of a Submersed Freshwater Macrophyte (Hydrilla Verticillata (L.F.)
W83-00830 2I

Shallow Dredging as a Strategy for the Control of Sublittoral Macrophytes: A Case Study in Tuggerah Lakes, New South Wales,
W83-00831 5G

MALAYSIA
Water Temperature Variability as an Indicator of Shallow-Depth Groundwater Behaviour in Limestone Areas in West Malaysia,
W83-01048 2F

MANGANESE
The Dynamics of Estuarine Manganese Cycling,
W83-00809 2L

MANGANESE OXIDES
Formation of Freshwater Fe-Mn Coatings on Gravel and the Behavior of Co60, Sr90, and Cs137 in a Small Watershed,
W83-00788 5B

MARYLAND
Forecasting Short-Term Revenues for Water and Sewer Utilities,
W83-01042 6D

MASSACHUSETTS
Hydrologic Effects of Highway-Deicing Chemicals in Massachusetts--Executive Summary,
W83-01008 4C

MATHEMATICAL EQUATIONS
Time of Concentration Determination for Small Watersheds,
W83-00871 2A

Unsteady Flow Studies in China,
W83-00936 8B

New Method for Tidal Current Computation,
W83-00939 2L

Nonlinear Diffraction by Eigenfunction Expansions,
W83-00942 8B

The Meaning of Matric Potential,
W83-00964 2I

MATHEMATICAL MODELS
Hydrogeology of the Umm Er Radhuma Aquifer, Saudi Arabia, With Reference to Fossil Gradients,
W83-00727 2F

Economics of the Water Blanket Technique for Greenhouse Heating,
W83-00762 3C

The Design of Looped Water Distribution Networks by Application of Linear Programming (Die Dimensionierung Von Vermaschten Wasserverteilungsnetzen Unter Anwendung Der Linearen Programmierung),
W83-00772 8B

Titanium and Tungsten in Highway Runoff at Pullman, Washington,
W83-00799 5B

Computer-Supported Flood Predictions for the Improvement of flood Protection in the DDR (Rechnergestutzte Hochwasservorhersagen zue Verbesserung des Hochwasserschutzes in der DDR),
W83-00976 2E

Calculations on a Model for the Future Behaviour of Griesgletscher, Wallis (Modellrechnungen zum Zukunftigen Verhalten des Griesgletschers, Wallis),
W83-00982 2C

Determination of Geohydraulic Parameters and the Infiltration Capacity of Sand Basins for Artificial Groundwater Enrichment (Bestimmung der Geohydraulischen Parameter und der Infiltrationsleistung von Sandbecken bei Kunstlicher Grundwasseranreicherung),
W83-00983 5G

MEASURING INSTRUMENTS
A Device to Measure in Situ Lotic Benthic Metabolism,
W83-00773 5B

MECHANICAL EQUIPMENT
Full Marks for Oxfam's Water Supply Package.
W83-00968 5F

MEMBRANE FILTERS
Evaluation of Factors Affecting the Membrane Filter Technique for Testing Drinking Water,
W83-01019 5A

METABOLISM
A Device to Measure in Situ Lotic Benthic Metabolism,
W83-00773 5B

METAL-GLUCONATE COMPLEXES
Examination and Evaluation of Biological Degrading of Metal Gluconate Complexes through the Zahn/Wallens Batch Method (Prufung und Bewertung der Biologischen Abbaubarkeit von me Gluconatkomplexen im Standversuch nach Zahn/Wellens),
W83-00972 5D

METALS
Distribution of Heavy Metals in Bottom Mud of Rivers VIII. Distribution of Total and Extractable Cd and Zn,
W83-00719 5B

Ecological Effects of Mine Effluents on the South Esk River, North-Eastern Tasmania, II. Trace Metals,
W83-00832 5B

Modern and Paleolimnological Evidence for Accelerated Leaching and Metal Accumulation in Soils in New England, Caused by Atmospheric Deposition,
W83-00956 5B

METHANOGENSIS
Electron Flow Via Sulfate Reduction and Methanogenesis in the Anaerobic Hypolimnion of Lake Mendota,
W83-00877 2H

MEXICO
The Los Azufres, Michoacan, Mexico, Geothermal Field,
W83-00903 2F

MICHIGAN
Water Resources Data, Michigan, Water Year 1981.
W83-00994 7C

MICROORGANISMS
Effect of Light Intensity of Sulfate Uptake and Primary Productivity by Natural Freshwater Microplankton Communities and Axenic Algal Cultures,
W83-00778 2H

Evidence of Microbial Succession on Decaying Leaf Litter in an Arctic Lake,
W83-00848 2H

MICROWAVES
A Rapid Technique for Obtaining Uniform Water Content Distributions in Unsaturated Soil Columns,
W83-00723 2G

MIDDLE EAST
Hydrogeological Conditions in the Middle East,
W83-00724 2F

MIGRATION
Aspects of the Biology of Estuarine Fish Populations Sampled From Power Station Trash Screens,
W83-00802 5C

MINE DRAINAGE
Ecological Effects of Mine Effluents on the South Esk River, North-Eastern Tasmania, II. Trace Metals,
W83-00832 5B

MINERAL SPRINGS
Equilibrium Status of Some Mineral Springs in Victoria,
W83-00760 2K

MINNESOTA
Irrigation Scheduling Using Crop Canopy-Air Temperature Difference,
W83-00887 3F

MISSOURI
Biotic Index Tested for Ability to Assess Water Quality of Missouri Ozark Streams,
W83-00728 5A

Socioeconomic Value of the Trout Fishery in Lake Taneycomo, Missouri,
W83-00872 6C

MISSOURI AFQUIFER
Hydraulic Properties of a Major Alluval Aquifer: An Isotropic, Inhomogeneous System--Comments,
W83-00899 2F

MISSOURI AQUIFER
Hydraulic Properties of a Major Alluvial Aquifer: An Isotropic, Inhomogeneous System--Reply,
W83-00898 2F

MIXING
Conditions for Gradient-Type Dispersive Transport in One-Dimensional Turbidity Averaged Transport Models,
W83-00815 2L

An Approach to the Study of Transverse Mixing in Streams,
W83-00909 2E

Hydromechanics of Tidal Jets,
W83-00938 2L

Investigation into Water Exchange in Reservoirs of Different Shapes and Different Arrangement of Inlet and Discharge Pipes,
W83-01035 5G

MODEL STUDIES
Predicting the Effects of Drainage Systems on Corn Yields,
W83-00748 4A

The Structure of Three-Dimensional Tide-Generating Currents: Experimental Verification of a Theoretical Model,
W83-00817 2L

A Model for the Design of Drainage in Flat Agricultural Lands,
W83-00820 4A

Local Energy Exchanges in a Shallow, Coastal Lagoon: Winter Conditions,
W83-00858 2L

A Comparison Between Vertically Integrated and Multilevel Models of Tidal Dynamics in Channels,
W83-00860 2L

Finite Element Model to Describe Overland Flow on an Infiltrating Watershed,
W83-00867 2E

Incorporating Crop Needs Into Drainage System Design,
W83-00886 3F

A Monitoring/Modeling Strategy for 208 Implementation,
W83-00890 5B

A Model to Derive Precipitation Patterns and Vertical Velocities in Large-Scale Rain Systems,
W83-00894 2B

Determining the Turnover Time of Groundwater Systems With the Aid of Environmental Tracers. 1. Models and Their Applicability,
W83-00908 2F

An Approach to the Study of Transverse Mixing in Streams,
W83-00909 2E

Hydraulic Model Study of Ute Dam Labyrinth Spillway,
W83-00920 8B

Hydraulic Interpretation of Grain-Size Distributions Using A Physical Model for Bedload Transport,
W83-00929 2J

Columbia River Entrance Channel Ship Motion Study,
W83-00935 8B

Sediment Transport on a Gentle Slope Due to Waves,
W83-00937 2J

New Method for Tidal Current Computation,
W83-00939 2L

Movable-Bed Tidal Inlet Model,
W83-00941 2L

Concepts for the Modelling of the Phosphorus Cycle in Lakes and Reservoirs (Modellvorstellungen uber den Phosphorkreislauf in Stehenden Gewassern),
W83-00971 5C

Finite Element Analysis of Horizontal and Vertical Turbulent Diffusion Problems in Lakes,
W83-01040 2H

MOISTURE AVAILABILITY
Predicting Height and Relative Performance of Major Southern Pines From Rainfall, Slope, and Available Soil Moisture,
W83-00769 2I

MOISTURE DEFICIENCY
Utility of Frequency Distribution of Moisture Adequacy in the Selection of Crops for Areas With Marginal Rainfall,
W83-00806 3F

MONITORING
Expanded Criteria for the Assessment of Water Quality in running Waters (Erweiterte Kriterien zue Beurteilung der Wasserbeschaffenheit in Fliessgewassern),
W83-00977 6F

Operations Monitoring System at the Helsinki City Waterworks,
W83-01032 5F

MONTANA
Appendix to Report on Assessment of Low-Head Hydroelectric Sites in the Western States; Evaluation Reports for Low-Head Hydroelectric Sites, Part V - Montana and Wyoming.
W83-00927 8A

Hydrology of the Prairie Dog Creek Drainage Basin, Rosebud and Big Horn Counties, Montana,
W83-00990 7C

Water Resources Data, Montana, Water Year 1981--Volume 2. Columbia River Basin.
W83-01002 7C

MONTE CARLO METHOD
Monte Carlo Study of the Nature of the Underwater Light Field in, and the Relationships Between Optical Properties of, Turbid Yellow Waters,
W83-01011 2H

MUD
Sedimentology of Muddy Fine-Grained Channel Deposits in Meandering Streams of the American Middle West,
W83-00933 2J

MUNICIPAL WASTES
Combined Treatment Plant Handles City and Paperboard Mill Effluent,
W83-00893 5D

MUNICIPAL WATER
The Water Supply of an Agglomeration Area in Switzerland,
W83-01017 5F

NATURAL RESOURCES
U.S. Geological Survey Activities, Fiscal Year 1981.
W83-01009 7C

Geological Survey Research 1981.
W83-01010 7C

NATURAL WATERS
High Resolution Vertical Profiles of pH in Recent Sediments,
W83-00729 5B

NAVIER-STOKES EQUATIONS
Accuracy of Finite Element Solutions of Navier-Stokes Equations Using a Velocity-Pressure Formulation,
W83-01039 2E

NAVIGATION
Columbia River Entrance Channel Ship Motion Study,
W83-00935 8B

NEARSHORE PROCESSES
Natural Fluorescence as a Tracer for Distinguishing Between Piedmont and Coastal Plain River Water in the Nearshore Waters of Georgia and North Carolina,
W83-00857 2L

NEBRASKA
Groundwater Levels in Nebraska, 1981,
W83-01004 2F

NEOMYSIS
Daphnia in Lake Washington,
W83-00703 2H

NETWORK DESIGN
The Design of Looped Water Distribution Networks by Application of Linear Programming (Die Dimensionierung Von Vermaschten Wasserverteilungsnetzen Unter Anwendung Der Linearen Programmierung),
W83-00772 8B

Drip Irrigation Lateral Line Network Design,
W83-00888 3F

NETWORKS
Rainfall Interstation Correlation Functions IV. On the Occurrence of Zero and Less-Than-Zero Response,
W83-00912 2B

NEW ENGLAND
Modern and Paleolimnological Evidence for Accelerated Leaching and Metal Accumulation in Soils in New England, Caused by Atmospheric Deposition,
W83-00956 5B

NEW JERSEY
Continuous Withdrawal from Selected Reservoir Strata.
W83-01043 8A

Metal Sulfides in Estuarine Sediments,
W83-01044 5B

NEW MEXICO
Yield of Alfalfa and Cotton as Influenced by Irrigation,
W83-00836 3F

Comparison of Sprinkler, Trickle, Subsurface, and Furrow Irrigation Methods for Row Crops,
W83-00840 3F

Hydraulic Model Study of Ute Dam Labyrinth Spillway,
W83-00920 8B

Appendix to Report of Assessment of Low-Head Hydroelectric Sites in the Western States; Evaluation Reports for Low-Head Hydroelectric Sites, Part IV - Kansas, New Mexico, Oklahoma, and Texas.
W83-00926 8A

NEW YORK
Copepod Communities in the Estuary and Coastal Plume of the Hudson River,
W83-00813 2L

NEW YORK BIGHT
Temporal Variability of Suspended Particulate Concentrations in the New York Bight,
W83-01045 2J

NEW ZEALAND
A Study of the Benthic Communities of Twenty Lakes in the South Island, New Zealand,
W83-00737 2H

Are New Zealnd Stream Ecosystems Really Different.,
W83-00885 2J

Raingauge Network Reduction,
W83-00900 7A

NICARAGUA
Physical Processes and Sedimentation on a Broad, Shallow Bank,
W83-00816 2J

A New Geothermal Anomaly in Nicaragua,
W83-00895 2F

NICKEL
Free Nickel Ion Concentration in Sewage by an Ion Exchange Column-Equilibration Method,
W83-00842 5A

NIGERIA
The Physico-Chemical Hydrology of a Tropical Seasonal River-Upper Ogun River,
W83-00706 2E

NITELLA
Methods of Analyzing Quinones in Water and Their Application in Studying the Effects of Hydrophytes on Phenols. Part 5: Elimination of Carcinogenic Amines From Solutions Under the Action of Nitella,
W83-00851 5D

NITRATES
Exchange of Nitrate, and the Products of Bacterial Nitrate Reduction, Between Seawater and Sediments From a U.K. Saltmarsh,
W83-00812 2L

Design and Testing of a New Microlysimeter for Leaching Studies,
W83-00821 7B

The Use of Bio-Technics in Water Treatment: Feasibility and Performance of Biological Treatment of Nitrates, (In French),
W83-01034 5F

NITRIFICATION
Design of Combined Nitrification-Dentrification Plants (Bemessung von Kombinierten Nitrifikations-und Denitrifikationsanlagen),
W83-00786 5D

NITROGEN
Design and Testing of a New Microlysimeter for Leaching Studies,
W83-00821 7B

Influence of Potassium Source (Sediment Vs. Open Water) and Sediment Composition on the Growth and Nutrition of a Submersed Freshwater Macrophyte (Hydrilla Verticillata (L.F.)
W83-00830 2I

Evidence of Microbial Succession on Decaying Leaf Litter in an Arctic Lake,
W83-00848 2H

NITROGEN REMOVAL
Stabilization of Waste-Activated Sludge Through the Anoxic-Aerobic Digestion Process,
W83-00713 5E

NONPOINT POLLUTION SOURCES
Agricultural Runoff as a Nonpoint Externality: A Theoretical Development,
W83-00747 5B

Distributional Constraints on Acceptance of Nonpoint Pollution Controls,
W83-00829 6C

A Monitoring/Modeling Strategy for 208 Implementation,
W83-00890 5B

Creation of Wetland Habitats in Northeastern Illinois,
W83-00944 5G

NORTH CAROLINA
Variable Effects of Sediment Addition on Stream Benthos,
W83-00730 4C

Predicting the Effects of Drainage Systems on Corn Yields,
W83-00748 4A

Sediment Nutrient Regeneration in Three North Carolina Estuaries,
W83-00811 2L

Natural Fluorescence as a Tracer for Distinguishing Between Piedmont and Coastal Plain River Water in the Nearshore Waters of Georgia and North Carolina,
W83-00857 2L

NORWAY
Sodium Mobility in a Mini-Catchment Studied With Radioactive Tracers and Artificial Precipitation,
W83-00753 5B

Runoff Chemistry at a Mini-Catchment Watered With 'Unpolluted Precipitation,'
W83-00754 5B

NOVA SCOTIA
Acidification of Nova Scotia Lakes I: Response of Diatom Assemblages in the Halifax Area,
W83-00960 5C

NUCLEAR POWERPLANTS
Water Decontamination Process Improvement Tests and Considerations,
W83-01037 5D

NUCLEATION
How Inhibitors Improve Economics of Scale,
W83-00970 8G

NUTRIENT REMOVAL
Oxygen Concentrations and Elimination of Inorganic Phosphorus and Nitrogen in an Experimental Watercourse Stocked With Emergent Macrophytes,
W83-00843 5D

NUTRIENT REQUIREMENTS
Role of Phosphorus in Activated Sludge,
W83-00861 5D

The Uptake of Phosphate by Carex Species for Oligotrophic to Eutrophic Swamp Habitats,
W83-00874 5B

NUTRIENTS
Nutrients and Phytoplankton in Three Shallow, Fresh-water Lakes of Different Trophic Status in Western Australia,
W83-00739 5C

The Phosphorus Economy of a Hypertrophic Seepage Lake in Scania, South Sweden Groundwater Influence,
W83-00777 2H

Sediment Nutrient Regeneration in Three North Carolina Estuaries,
W83-00811 2L

Influence of Potassium Source (Sediment Vs. Open Water) and Sediment Composition on the Growth and Nutrition of a Submersed Freshwater Macrophyte (Hydrilla Verticillata (L.F.)
W83-00830 2I

Nutrient Retention and Macroinvertebrate Community Structure in a Small Stream Receiving Sewage Effluent,
W83-00844 5C

OCEAN DUMPING
Ocean Dumping of Sewage Sludge: The Tide Turns From Protection to Management,
W83-00732 6E

Open Ocean Disposal of Materials Dredged from a Highly Industrialized Estuary: An Evaluation of Potential Lethal Effects,
W83-01030 5E

OHIO
Water Resources Data, Ohio, Water Year 1981--Volume 1. Ohio River Basin.
W83-01000 7C

Water Resources Data, Ohio, Water Year 1981--Volume 2. St. Lawrence River Basin Statewide Project Data.
W83-01001 7C

OKLAHOMA
The Effects of Nutrient, pH and Herbicide Levels on Algal Growth,
W83-00707 5C

Appendix to Report of Assessment of Low-Head Hydroelectric Sites in the Western States; Evaluation Reports for Low-Head Hydroelectric Sites, Part IV - Kansas, New Mexico, Oklahoma, and Texas.
W83-00926 8A

Sulfur Isotopic Composition and Water Chemistry in Water from the High Plains Aquifer, Oklahoma Panhandle and Southwestern Kansas,
W83-00987 2F

Water Type and Suitability of Oklahoma Surface Waters for Public Supply and Irrigation. Part 2: Salt Fork Arkansas River and Cimarron River Basins Through 1978,
W83-00989 7C

OLIGOCHAETES
Effect of Thermal Effluents on Oligochaetes in Keowee Reservoir, South Carolina,
W83-00731 5C

ONTARIO
Limnology of Heart Lake, Ontario,
W83-00774 2H

The Use of Calibrated Lakes and Watersheds for Estimating Atmospheric Deposition Near a Large Point Source,
W83-00953 5B

The Significance of Surface Temperature Patterns on the Energy Balance of a Small Lake in the Canadian Shield,
W83-01029 2H

OPERATIONS
Operations Monitoring System at the Helsinki City Waterworks,
W83-01032 5F

OREGON
Appendix to Report on Assessment of Low-Head Hydroelectric Sites in the Western States; Evaluation Reports for Low-Head Hydroelectric Sites, Part VI - Oregon and Washington.
W83-00928 8A

Water-Quality Assessment of the Smith River Drainage Basin, California and Oregon.
W83-01006 7C

ORGANIC CARBON
Nutrient Retention and Macroinvertebrate Community Structure in a Small Stream Receiving Sewage Effluent,
W83-00844 5C

Total Organic Carbon in Lake Superior Sediments: Comparisons With Hemipelagic and Pelagic Marine Environments,
W83-00878 2H

ORGANIC COMPOUNDS
Large Bore Coated Columns in Analysis for Trace Organic Pollutants in Water,
W83-00963 5A

ORGANIC MATTER
Interactions Between Suspended Organic Matter and Copepod Grazing in the Plume of the Hudson River,
W83-00793 2L

Heterotrophic Activity and Biodegradation of Labile and Refractory Compounds by Groundwater and Stream Microbial Populations,
W83-01021 2F

ORGANIC SOLVENTS
Trace Metal Partitioning in the Aqueous Surface Microlayer of a Salt Marsh,
W83-00814 5B

OSCILLATORY WAVES
Sediment Transport on a Gentle Slope Due to Waves,
W83-00937 2J

OVERLAND FLOW
Finite Element Model to Describe Overland Flow on an Infiltrating Watershed,
W83-00867 2E

OXIDATION
Cooxidation of Benzo(A)Pyrene and Phenols on Activated Sludges,
W83-00866 5D

PARTICULATE MATTER
Aggregates of Particulate Matter and Aufwuchs on Elodea Canadensis in Irrigation Waters, and Inactivation of Diquat,
W83-00741 4A

PASTURES
Crop Evaporation, Surface Resistance and Soil Water Status,
W83-00856 2I

PATH OF POLLUTANTS
Measurement of Time of Travel and Dispersion in Streams by Dye Tracing,
W83-00985 5B

PENNSYLVANIA
Water Resources Data, Pennsylvania, Water Year 1981--Volume 3. Ohio River and St. Lawrence River Basin.
W83-00997 7C

Water Resources Data, Pennsylvania, Water Year 1981--Volume 2. Susquehanna and Potomac River Basins.
W83-00998 7C

PERU
The Value of Iodide as a Parameter in the Chemical Characterisation of Groundwaters,
W83-00901 2F

Clear Water from Coastal Fogs.
W83-00980 3B

PESTICIDES
Dispersive Transfer and Pesticide Propagation in a Submerged Rice-Field (Transferts Dispersifs et Propagation de Pesticides Dans un Sol de Riziere Inondee),
W83-00907 5B

U. S. Geological Survey Standard Reference Water Samples for Pesticides,
W83-01005 5G

PHENOL
Transformation of Benzo(a)pyrene in a Mixture with Phenols under the Effect of Algae and Their Enzyme Preparations,
W83-00961 5B

PHENOLS
Methods of Analyzing Quinones in Water and Their Application in Studying the Effects of Hydrophytes on Phenols. Part 3: Phenol Elimination Under the Action of Aquatic Plants,
W83-00852 5D

Methods of Analyzing Quinones in Water and Their Application in Studying the Effects of Hydrophytes on Phenols. Part 2: Polarographic Methods of Quinone Analysis,
W83-00864 5A

Methods of Analyzing Quiones in Water and Their Application in Studying the Effects of Hydrophytes on Phenols. Part 1: Quinone Determination With Benzene Sulfinic Acid,
W83-00865 5A

PHOSPHATE
Nutrient Retention and Macroinvertebrate Community Structure in a Small Stream Receiving Sewage Effluent,
W83-00844 5C

PHOSPHATES
The Uptake of Phosphate by Carex Species for Oligotrophic to Eutrophic Swamp Habitats,
W83-00874 5B

PHOSPHORUS
Influence of Potassium Source (Sediment Vs. Open Water) and Sediment Composition on the Growth and Nutrition of a Submersed Freshwater Macrophyte (Hydrilla Verticillata (L.F.)
W83-00830 2I

Role of Phosphorus in Activated Sludge,
W83-00861 5D

Concepts for the Modelling of the Phosphorus Cycle in Lakes and Reservoirs (Modellvorstellungen uber den Phosphorkreislauf in Stehenden Gewassern),
W83-00971 5C

PHOTOSYNTHESIS
Daily Patterns of Apparent Photosynthesis and Evapotranspiration in a Developing Winter Wheat Crop,
W83-00823 2D

PHYSICAL PROPERTIES
Physical Properties of Great Barrier Reef Lagoon Waters Near Townsville. I. Effects of Burdekin River Floods,
W83-00759 2L

Physical Processes and Sedimentation on a Broad, Shallow Bank,
W83-00816 2J

Biological, Chemical and Physical Responses of Lakes to Experimental Acidification,
W83-00957 5C

PHYSICOCHEMICAL PROPERTIES
The Physico-Chemical Hydrology of a Tropical Seasonal River-Upper Ogun River,
W83-00706 2E

Environmental Characteristics of the Mandovi-Zuari Estuarine System in Goa,
W83-00804 2L

PHYTOPLANKTON
Daphnia in Lake Washington,
W83-00703 2H

Dynamics of Phytoplankton in the Brackish Water Inlet Pojoviken, Southern Coast of Finland,
W83-00709 2L

Phytoplankton Ecology of the Lake of Menteith, Scotland,
W83-00711 2H

Studies on the Decompositive Processes of Phytoplanktonic Organic Matter,
W83-00720 2H

Nutrients and Phytoplankton in Three Shallow, Fresh-water Lakes of Different Trophic Status in Western Australia,
W83-00739 5C

PIEDMONT REGION
Runoff Water Quality From Dairy Pastures in the Piedmont Region,
W83-00870 5B

PINE TREES
Predicting Height and Relative Performance of Major Southern Pines From Rainfall, Slope, and Available Soil Moisture,
W83-00769 2I

PIPELINES
Effects of Stream-Crossing by a Pipeline on the Benthic Macroinvertebrate Communities of a Small Mountain Stream,
W83-00789 5C

PLANNING
Water From Power: Water Supply and Regional Growth in the Santa Clara Valley,
W83-00795 6D

Streamflow Information for Connecticut with Applications to Land-Use Planning,
W83-00992 3E

PLANT GROWTH
Effects of Repeated Application of Water Stress on Water Status and Growth of Wheat,
W83-00875 2I

PLANT WATER POTENTIAL
Effects of Repeated Application of Water Stress on Water Status and Growth of Wheat,
W83-00875 2I

The Meaning of Matric Potential,
W83-00964 2I

PLANTING MANAGEMENT
Predicting Height and Relative Performance of Major Southern Pines From Rainfall, Slope, and Available Soil Moisture,
W83-00769 2I

POLAND
Ecology of the Forest Stream Lane Bloto in the Niepolomice Forest 1. Chemism of Water and Bottom Sediments and its Changes Under the Influence of Industrial Pollution,
W83-00763 5B

Determining the Turnover Time of Groundwater Systems With the Aid of Environmental Tracers. 1. Models and Their Applicability,
W83-00908 2F

Diffused Type Pollution Control for Catchment Areas of Rivers Used to Provide Drinking Water,
W83-01031 5G

POLAROGRAPHIC ANALYSIS
Methods of Analyzing Quinones in Water and Their Application in Studying the Effects of Hydrophytes on Phenols. Part 2: Polarographic Methods of Quinone Analysis,
W83-00864 5A

POLITICAL ASPECTS
The Politics of Water Pollution Control: A Case Study of the Canadian Fisheries Act Amendments and the Pulp and Paper Effluent Regulations, 1970,
W83-00951 6E

POLLUTANT IDENTIFICATION
Gas Chromatographic Analysis of Trace Hydrocarbon Pollutants in Water Samples,
W83-00800 5A

Determination of Sulphide Ion at Trace Levels by Ethylation and Gas Chromatography,
W83-00805 5A

Determination of Trace Levels of Quaternary Ammonium Compounds in River Water by Liquid Chromatography With Conductometric Detection,
W83-00841 5A

Free Nickel Ion Concentration in Sewage by an Ion Exchange Column-Equilibration Method,
W83-00842 5A

Methods of Analyzing Quiones in Water and Their Application in Studying the Effects of Hydrophytes on Phenols. Part 1: Quinone Determination With Benzene Sulfinic Acid,
W83-00865 5A

Large Bore Coated Columns in Analysis for Trace Organic Pollutants in Water,
W83-00963 5A

Spectrophotometric Determination of Sulphide in Water by Re-Extraction and Ligand Exchange Using Chloroform Solutions of Copper Quinolin-8-Olate,
W83-01036 5A

POLLUTANT LOAD
A Method for the Evaluation of Effluent Quality of Various Mechanical Pulping Processes,
W83-00750 5A

POLLUTANTS
Cyclical Relationships Between River Discharge and Chemical Concentration During Flood Events,
W83-01046 2E

POLLUTANTS IDENTIFICATION
Methods of Analyzing Quinones in Water and Their Application in Studying the Effects of Hydrophytes on Phenols. Part 2: Polarographic Methods of Quinone Analysis,
W83-00864 5A

POLYNUCLEAR AROMATIC COMPOUNDS
Cooxidation of Benzo(A)Pyrene and Phenols on Activated Sludges,
W83-00866 5D

PONDS
Algal Dynamics in Relation to Physico-Chemical Factors in a High Altitude Pond of Shillong, India,
W83-00853 2H

Primary Productivity in Relation to the Abiotic Factors in a Temporary Freshwater Pond,
W83-00854 2H

POPULATION DYNAMICS
Effect of Thermal Effluents on Oligochaetes in Keowee Reservoir, South Carolina,
W83-00731 5C

The St. Lawrence River in Winter: Population Structure, Biomass, and Pattern of its Primary and Secondary Food Web Components,
W83-00779 2C

Algal Dynamics in Relation to Physico-Chemical Factors in a High Altitude Pond of Shillong, India,
W83-00853 2H

PORE PRESSURE
Control of Pore Water Pressures at the Zervreila Arch Dam (Messen von Porenwasserdruck im Untergrund der Bogenstaumauer Zervreila),
W83-00973 8D

POROSITY
Prediction and Control of Porosity and Water Retention in Sand-Soil Mixtures for Drained Turf Sites,
W83-00822 2G

POTASSIUM
Influence of Potassium Source (Sediment Vs. Open Water) and Sediment Composition on the Growth and Nutrition of a Submersed Freshwater Macrophyte (Hydrilla Verticillata (L.F.)
W83-00830 2I

POTATOES
Influence of Irrigation of the Development and Yield of Potatoes,
W83-00833 3F

POTOMAC RIVER
Water Quality of the Tidal Potomac River and Estuary, Hydrologic Data Report, 1980 Water Year,
W83-00984 7C

POWERPLANTS
Seabed Drifter Movement in San Diego Bay and Adjacent Waters,
W83-00738 2L

Use of Conventional Fishery Models to Assess Entrainment and Impingement of Three Lake Michigan Fish Species,
W83-00891 8I

PRECIPITATION
Sodium Mobility in a Mini-Catchment Studied With Radioactive Tracers and Artificial Precipitation,
W83-00753 5B

Runoff Chemistry at a Mini-Catchment Watered With 'Unpolluted Precipitation,'
W83-00754 5B

A Model to Derive Precipitation Patterns and Vertical Velocities in Large-Scale Rain Systems,
W83-00894 2B

Mitigating Drought Through Weather Modification: Selected Institutional and Meteorological Issues in Texas; Volume Three, Precipitation Climatology for the Edwards Plateau Region of Texas,
W83-00916 3B

Mitigating Drought Through Weather Modification: Selected Institutional and Meteorological Issues in Texas; Volume Four, an Objective Study of the Upper-Air Conditions Relating to Precipitation Over the Southeastern Section of the Edwards Plateau in Texas,
W83-00917 3B

PREDATION
Daphnia in Lake Washington,
W83-00703 2H

PREDICTION
Unreliabilities of Pressure Plate 1500 Kilopascal Data in Predicting Soil Water Contents at Which Plants Become Wilted in Soil-Peat Mixes,
W83-00782 2G

A Model to Derive Precipitation Patterns and Vertical Velocities in Large-Scale Rain Systems,
W83-00894 2B

PRIMARY PRODUCTIVITY
Primary Production in Three Lakes of Differing Salinity in Victoria, Australia,
W83-00775 2H

Primary Productivity in Relation to the Abiotic Factors in a Temporary Freshwater Pond,
W83-00854 2H

PRODUCTIVITY
Limnology of Perched Lake, South-West Tasmania,
W83-00742 2H

Physical Characteristics of an Inshore Area on the Atlantic Coast of Brittany and Their Influence on the Pelagic Ecosystem: The Case of the 'Riviere D'Etel',
W83-00792 2L

Copepod Communities in the Estuary and Coastal Plume of the Hudson River,
W83-00813 2L

Attached and Free-Floating Bacteria in the Fraser River Estuary, British Columbia, Canada,
W83-00879 2L

Structure and Productivity of Epiphytic Algal Communities on Lobelia Dortmanna L. in Acidified and Limed Lakes,
W83-00959 5G

PROJECTIONS
Calculations on a Model for the Future Behaviour of Griesgletscher, Wallis (Modellrechnungen zum Zukunftigen Verhalten des Griesgletschers, Wallis),
W83-00982 2C

PROTOZOA
The Trophic Response of Ciliated Protozoans in Freshwater Lakes,
W83-00704 5C

Ciliated Protozoa and Water Quality in the Torrente Stirone (Northern Italy),
W83-00749 5C

PSYCHROMETERS
A Screen-Caged Thermcouple Psychrometer and Calibration Chamber for Measurements of Plant and Soil Water Potential,
W83-00827 7B

PUBLIC RIGHTS
The Availability of Private Remedies for Acid Rain Damage,
W83-00794 6E

PULP AND PAPER INDUSTRY
A Method for the Evaluation of Effluent Quality of Various Mechanical Pulping Processes,
W83-00750 5A

Reduction of Toxicity and Mutagenicity of Chlorination Effluents With Sulphur Dioxide,
W83-00764 5D

Combined Treatment Plant Handles City and Paperboard Mill Effluent,
W83-00893 5D

The Politics of Water Pollution Control: A Case Study of the Canadian Fisheries Act Amendments and the Pulp and Paper Effluent Regulations, 1970,
W83-00951 6E

PUMPAGE
Water-Level Trends, Pumpage, and Chemical Quality in the Cambrian-Ordovician Aquifer in Illinois, 1971-1980,
W83-00947 6D

PUMPING
Numerical Modeling of Salt-Water Intrusion in the Northern Guam Lens,
W83-00946 4B

QATAR
The Value of Iodide as a Parameter in the Chemical Characterisation of Groundwaters,
W83-00901 2F

QUATERNARY AMMONIUM COMPOUNDS
Determination of Trace Levels of Quaternary Ammonium Compounds in River Water by Liquid Chromatography With Conductometric Detection,
W83-00841 5A

QUINONES
Methods of Analyzing Quinones in Water and Their Application in Studying the Effects of Hydrophytes on Phenols. Part 3: Phenol Elimination Under the Action of Aquatic Plants,
W83-00852 5D

Methods of Analyzing Quinones in Water and Their Application in Studying the Effects of Hydrophytes on Phenols. Part 2: Polarographic Methods of Quinone Analysis,
W83-00864 5A

QUIONES
Methods of Analyzing Quiones in Water and Their Application in Studying the Effects of Hydrophytes on Phenols. Part 1: Quinone Determination With Benzene Sulfinic Acid,
W83-00865 5A

RADAR
C-Band Radar for Determining Surface Soil Moisture,
W83-00735 7B

Mitigating Drought through Weather Modification: Selected Institutional and Meteorological Issues in Texas; Volume Two, Radar Echo Characteristics in the Edwards Plateau - Balcones Escarpment Area of Texas,
W83-00915 3B

RADIOACTIVE WASTES
Local Variability in the Distribution of Windscale Fission Products in Estuarine Sediments,
W83-00810 5B

Water Decontamination Process Improvement Tests and Considerations,
W83-01037 5D

RADIOISOTOPES
Formation of Freshwater Fe-Mn Coatings on Gravel and the Behavior of Co60, Sr90, and Cs137 in a Small Watershed,
W83-00788 5B

RADIONUCLIDES
Local Variability in the Distribution of Windscale Fission Products in Estuarine Sediments,
W83-00810 5B

The Application of Radioisotopes in the Study of Estuarine Sedimentary Processes,
W83-00818 5B

RAIN GAGES
Raingauge Network Reduction,
W83-00900 7A

An Automatic Recording Raingage Network for a Cloud-Seeding Experiment,
W83-00950 7A

RAINFALL
Temporal and Spatial Variation of Rainfall Anomalies in Africa South of Latitude 22 Deg During the Period of Meteorological Record,
W83-00863 2B

The Estimation of Rain From Satellite-Borne Microwave Radiometers,
W83-00876 2B

A Model to Derive Precipitation Patterns and Vertical Velocities in Large-Scale Rain Systems,
W83-00894 2B

Stochastic Modelling of Monthly Rainfall,
W83-00910 2B

Rainfall Interstation Correlation Functions IV. On the Occurrence of Zero and Less-Than-Zero Response,
W83-00912 2B

Rainfall Results of the Florida Area Cumulus Experiment, 1970-76,
W83-00962 3B

RAINFALL DISTRIBUTION

Temporal and Spatial Variation of Rainfall Anomalies in Africa South of Latitude 22 Deg During the Period of Meteorological Record,
W83-00863 2B

Mitigating Drought through Weather Modification: Selected Institutional and Meteorological Issues in Texas; Volume Two, Radar Echo Characteristics in the Edwards Plateau - Balcones Escarpment Area of Texas,
W83-00915 3B

Mitigating Drought Through Weather Modification: Selected Institutional and Meteorological Issues in Texas; Volume Three, Precipitation Climatology for the Edwards Plateau Region of Texas,
W83-00916 3B

RAINFALL-RUNOFF RELATIONSHIPS

Time of Concentration Determination for Small Watersheds,
W83-00871 2A

A Lumped-Parameter Model for Infiltration,
W83-00913 2G

RECHARGE

A New Geothermal Anomaly in Nicaragua,
W83-00895 2F

A Nonlinear Optimisation Method for Aquifer Parameter Estimation.
W83-00905 2F

Seasonal Patterns of Soil Water Recharge and Extraction on Semidesert Ranges,
W83-00932 2G

Numerical Modeling of Salt-Water Intrusion in the Northern Guam Lens,
W83-00946 4B

REGIONAL ANALYSIS

Temporal and Spatial Variation of Rainfall Anomalies in Africa South of Latitude 22 Deg During the Period of Meteorological Record,
W83-00863 2B

REGRESSION ANALYSIS

Predicting Height and Relative Performance of Major Southern Pines From Rainfall, Slope, and Available Soil Moisture,
W83-00769 2I

REMOTE SENSING

C-Band Radar for Determining Surface Soil Moisture,
W83-00735 7B

The Estimation of Rain From Satellite-Borne Microwave Radiometers,
W83-00876 2B

Measurement of Snow Water Storage in the Lake Superior Basin Using Aerial Gamma-Ray Spectrometry,
W83-00965 7B

RESERVOIR RELEASES

On the Heat Exchange Between Rivers and Atmosphere,
W83-00752 2A

Continuous Withdrawal from Selected Reservoir Strata.
W83-01043 8A

RESERVOIRS

Limnology of Shallow Lakes and Reservoirs (Limnologie Flacher Seen und Talsperren),
W83-00981 2H

Kielder Water (UK) Project Has Royal Opening.
W83-01033 8A

Investigation into Water Exchange in Reservoirs of Different Shapes and Different Arrangement of Inlet and Discharge Pipes,
W83-01035 5G

RESISTANCE

Selection of Antibiotic-Resistant Standard Plate Count Bacteria During Water Treatment,
W83-01020 5F

RESPIRATION

Community Metabolism of Intertidal Flats in the Ems-Dollard Estuary,
W83-00702 2L

REVERSE OSMOSIS

RO Suppliers Look to Wind and Sun to Power Rural Systems.
W83-00969 3A

Desalter Systems for Man-Made Islands,
W83-00979 3A

REVIEWS

Ocean Dumping of Sewage Sludge: The Tide Turns From Protection to Management,
W83-00732 6E

U.S. Geological Survey Activities, Fiscal Year 1981.
W83-01009 7C

A Review of Rainwater Harvesting,
W83-01025 3B

RHINE RIVER

The Development of the Salt Problem in the Rhine in the 60's and 70's (Die Entwicklung des Salz-Problems am Rhein in den 60er und 70er Jahren).
W83-00785 5G

RICE

Design and Testing of a Microlysimeter for Wetland Rice,
W83-00826 2D

Evapotranspiration Studies on Rice in Relation to Water Use Efficiency,
W83-00868 3F

RIVER STAGES

Hydraulic Properties of a Major Alluvial Aquifer: An Isotropic, Inhomogeneous System--Reply,
W83-00898 2F

Hydraulic Properties of a Major Alluval Aquifer: An Isotropic, Inhomogeneous System--Comments,
W83-00899 2F

RIVER TRAINING

Design and Construction of Flexible Groynes (Entwurf und bau Flexibler Buhnen),
W83-00974 8B

RIVERS

Distribution of Heavy Metals in Bottom Mud of Rivers VIII. Distribution of Total and Extractable Cd and Zn,
W83-00719 5B

Rating Curves for Rivers With Overbank Flow,
W83-00751 2E

Bacterial Flora of the Water and Sediment in the Edo River Mouth (In Japanese),
W83-00781 5C

Interactions Between Suspended Organic Matter and Copepod Grazing in the Plume of the Hudson River,
W83-00793 2L

Columbia River Entrance Channel Ship Motion Study,
W83-00935 8B

The Cation Denudation Rate as a Quantitative Index of Sensitivity of Eastern Canadian Rivers to Acidic Atmospheric Precipitation,
W83-00955 5C

Diffused Type Pollution Control for Catchment Areas of Rivers Used to Provide Drinking Water,
W83-01031 5G

ROAD CONSTRUCTION

Variable Effects of Sediment Addition on Stream Benthos,
W83-00730 4C

ROOTED AQUATIC PLANTS

The Uptake of Phosphate by Carex Species for Oligotrophic to Eutrophic Swamp Habitats,
W83-00874 5B

RUNNING WATERS

Expanded Criteria for the Assessment of Water Quality in running Waters (Erweiterte Kriterien zue Beurteilung der Wasserbeschaffenheit in Fliessgewassern),
W83-00977 6F

RUNOFF

Runoff Water Quality From Dairy Pastures in the Piedmont Region,
W83-00870 5B

A Siphon Device for Fractionation of Runoff Samples,
W83-00884 7B

Soil Erosion and Runoff From Planting to Canopy Development as Influenced by Tractor Wheel-Traffic,
W83-00889 4D

SALINE SOILS

Drainage of an Irrigated Saline Soil in Alberta,
W83-00850 4A

SALINE WATER

Chemical Variability in the Tamar Estuary, South-West England,
W83-00807 2L

Conditions for Gradient-Type Dispersive Transport in One-Dimensional Turbidity Averaged Transport Models,
W83-00815 2L

The Value of Iodide as a Parameter in the Chemical Characterisation of Groundwaters,
W83-00901 2F

Quality of Underground Irrigation Waters in Semi-Arid Tract of District Agra. III. Tehsils Bay and Fatehabad,
W83-01023 2K

SALINITY
Salinity Levels and Water Exchange in Gamo Lagoon,
W83-00716 2L

Physical Properties of Great Barrier Reef Lagoon Waters Near Townsville. I. Effects of Burdekin River Floods,
W83-00759 2L

Primary Production in Three Lakes of Differing Salinity in Victoria, Australia,
W83-00775 2H

Unsteady Flow Studies in China,
W83-00936 8B

SALT MARSHES
Hydrogen as an Electron Donor for Sulfate-Reducing Bacteria in Slurries of Salt Marsh Sediment,
W83-00701 2L

Trace Metal Partitioning in the Aqueous Surface Microlayer of a Salt Marsh,
W83-00814 5B

SAMPLING
A Siphon Device for Fractionation of Runoff Samples,
W83-00884 7B

Raingauge Network Reduction,
W83-00900 7A

A Flow-Proportional Sampler for Plot and Lysimeter Studies,
W83-00911 7B

SAN DIEGO BAY
Seabed Drifter Movement in San Diego Bay and Adjacent Waters,
W83-00738 2L

SAND BASINS
Determination of Geohydraulic Parameters and the Infiltration Capacity of Sand Basins for Artificial Groundwater Enrichment (Bestimmung der Geohydraulischen Parameter und der Infiltrationsleistung von Sandbecken bei Kunstlicher Grundwasseranreicherung),
W83-00983 5G

SANDSTONES
Hydrogeology of the Umm Er Radhuma Aquifer, Saudi Arabia, With Reference to Fossil Gradients,
W83-00727 2F

SANTA CLARA VALLEY
Water From Power: Water Supply and Regional Growth in the Santa Clara Valley,
W83-00795 6D

SASKATCHEWAN
Howe Lake: A Hydrodynamic Blowout Structure,
W83-00847 2H

SATELLITE TECHNOLOGY
The Estimation of Rain From Satellite-Borne Microwave Radiometers,
W83-00876 2B

SAUDI ARABIA
Hydrogeology of the Umm Er Radhuma Aquifer, Saudi Arabia, With Reference to Fossil Gradients,
W83-00727 2F

SCALING
How Inhibitors Improve Economics of Scale,
W83-00970 8G

SCOTLAND
Phytoplankton Ecology of the Lake of Menteith, Scotland,
W83-00711 2H

SEASONAL VARIATION
The Physico-Chemical Hydrology of a Tropical Seasonal River-Upper Ogun River,
W83-00706 2E

The St. Lawrence River in Winter: Population Structure, Biomass, and Pattern of its Primary and Secondary Food Web Components,
W83-00779 2C

Physical Characteristics of an Inshore Area on the Atlantic Coast of Brittany and Their Influence on the Pelagic Ecosystem: The Case of the 'Riviere D'Etel',
W83-00792 2L

Aspects of the Biology of Estuarine Fish Populations Sampled From Power Station Trash Screens,
W83-00802 5C

Water Deficiency in Dharwad District,
W83-01022 2B

SEAWATER
Seawater Intrusion in Continuous Coastal Aquifer-Aquitard Systems,
W83-01028 2F

SEDIMENT LOAD
Hydraulic Interpretation of Grain-Size Distributions Using A Physical Model for Bedload Transport,
W83-00929 2J

SEDIMENT TRANSPORT
Sediment-Delivery Ratios for a Small Coastal Plain Agricultural Watershed,
W83-00869 2J

Hydraulic Interpretation of Grain-Size Distributions Using A Physical Model for Bedload Transport,
W83-00929 2J

Sediment Transport on a Gentle Slope Due to Waves,
W83-00937 2J

SEDIMENT YIELD
Impact of Incremental Surface Soil Depths on Infiltrations Rates, Potential Sediment Losses, and Chemical Water Quality,
W83-00934 2J

SEDIMENTARY STRUCTURES
Hydrogeology of the Kufra and Sirte Basins, Eastern Libya,
W83-00725 2F

SEDIMENTATION
High Resolution Vertical Profiles of pH in Recent Sediments,
W83-00729 5B

Variable Effects of Sediment Addition on Stream Benthos,
W83-00730 4C

Physical Processes and Sedimentation on a Broad, Shallow Bank,
W83-00816 2J

The Application of Radioisotopes in the Study of Estuarine Sedimentary Processes,
W83-00818 5B

Are New Zealnd Stream Ecosystems Really Different.,
W83-00885 2J

Hydraulic Interpretation of Grain-Size Distributions Using A Physical Model for Bedload Transport,
W83-00929 2J

The Applicability of the Gibbs Euation for Grain Settling Velocities to Conditions Other Than Quartz Grains in Water,
W83-00930 2J

Composition of Modern Stream Sand in a Humid Climate Derived From a Low-Grade Metamorphic and Sedimentary Foreland Fold-Thrust Belt of North Georgia,
W83-00931 2J

SEDIMENTATION RATES
Vertical Distribution of 137-CS and its Accumulation Rate in Lake Sediments,
W83-00780 2J

SEDIMENTS
Aquatic Distribution and Heterotrophic Degradation of Polycyclic Aromatic Hydrocarbons (PAH) in the Tamar Estuary,
W83-00808 5B

Local Variability in the Distribution of Windscale Fission Products in Estuarine Sediments,
W83-00810 5B

Sediment Nutrient Regeneration in Three North Carolina Estuaries,
W83-00811 2L

Influence of Potassium Source (Sediment Vs. Open Water) and Sediment Composition on the Growth and Nutrition of a Submersed Freshwater Macrophyte (Hydrilla Verticillata (L.F.)
W83-00830 2I

Sediment-Delivery Ratios for a Small Coastal Plain Agricultural Watershed,
W83-00869 2J

Sedimentology of Muddy Fine-Grained Channel Deposits in Meandering Streams of the American Middle West,
W83-00933 2J

Unsteady Flow Studies in China,
W83-00936 8B

Metal Sulfides in Estuarine Sediments,
W83-01044 5B

SETTLEABLE SOLIDS
The Applicability of the Gibbs Euation for Grain Settling Velocities to Conditions Other Than Quartz Grains in Water,
W83-00930 2J

SETTLING VELOCITY
The Applicability of the Gibbs Euation for Grain Settling Velocities to Conditions Other Than Quartz Grains in Water,
W83-00930 2J

SHEAR STRESS
Rating Curves for Rivers With Overbank Flow,
W83-00751 2E

SILICA
Natural Fluorescence as a Tracer for Distinguishing Between Piedmont and Coastal Plain River Water in the Nearshore Waters of Georgia and North Carolina,
W83-00857 2L

SITE SELECTION
Report on Assessment of Low-Head Hydroelectric Sites in the Western States; Methology and Summary.
W83-00922 6C

SITES
Water Resources Programs of the U.S. Geological Survey Related to Agriculture in Louisiana,
W83-01007 7C

SLUDGE
Examination and Evaluation of Biological Degrading of Metal Gluconate Complexes through

the Zahn/Wallens Batch Method (Prufung und Bewertung der Biologischen Abbaubarkeit von me Gluconatkomplexen im Standversuch nach Zahn/Wellens),
W83-00972 5D

SLUDGE DIGESTION
Stabilization of Waste-Activated Sludge Through the Anoxic-Aerobic Digestion Process,
W83-00713 5E

SLUDGE DISPOSAL
Ocean Dumping of Sewage Sludge: The Tide Turns From Protection to Management,
W83-00732 6E

SMALL WATERSHEDS
Time of Concentration Determination for Small Watersheds,
W83-00871 2A

SNOW COVER
Measurement of Snow Water Storage in the Lake Superior Basin Using Aerial Gamma-Ray Spectrometry,
W83-00965 7B

SODIUM CHLORIDE
Hydrologic Effects of Highway-Deicing Chemicals in Massachusetts--Executive Summary,
W83-01008 4C

SOIL CHEMISTRY
Sodium Mobility in a Mini-Catchment Studied With Radioactive Tracers and Artificial Precipitation,
W83-00753 5B

Runoff Chemistry at a Mini-Catchment Watered With 'Unpolluted Precipitation,'
W83-00754 5B

SOIL COLUMNS
A Rapid Technique for Obtaining Uniform Water Content Distributions in Unsaturated Soil Columns,
W83-00723 2G

SOIL FOUNDATIONS
Frost Action in Soil Foundations and Control of Surface Structure Heaving,
W83-00919 8D

SOIL MANAGEMENT
Soil Erosion and Runoff From Planting to Canopy Development as Influenced by Tractor Wheel-Traffic,
W83-00889 4D

SOIL MECHANICS
Frost Action in Soil Foundations and Control of Surface Structure Heaving,
W83-00919 8D

SOIL MOISTURE RETENTION
Predicting Height and Relative Performance of Major Southern Pines From Rainfall, Slope, and Available Soil Moisture,
W83-00769 2I

Seasonal Patterns of Soil Water Recharge and Extraction on Semidesert Ranges,
W83-00932 2G

SOIL POROSITY
Prediction and Control of Porosity and Water Retention in Sand-Soil Mixtures for Drained Turf Sites,
W83-00822 2G

SOIL PROPERTIES
Unreliabilities of Pressure Plate 1500 Kilopascal Data in Predicting Soil Water Contents at Which Plants Become Wilted in Soil-Peat Mixes,
W83-00782 2G

Modern and Paleolimnological Evidence for Accelerated Leaching and Metal Accumulation in Soils in New England, Caused by Atmospheric Deposition,
W83-00956 5B

SOIL TESTS
A Rapid Technique for Obtaining Uniform Water Content Distributions in Unsaturated Soil Columns,
W83-00723 2G

SOIL WATER
The Three-Parameter Infiltration Equation,
W83-00734 2G

C-Band Radar for Determining Surface Soil Moisture,
W83-00735 7B

Unreliabilities of Pressure Plate 1500 Kilopascal Data in Predicting Soil Water Contents at Which Plants Become Wilted in Soil-Peat Mixes,
W83-00782 2G

Design and Testing of a New Microlysimeter for Leaching Studies,
W83-00821 7B

SOIL-WATER-PLANT RELATIONSHIPS
Predicting Height and Relative Performance of Major Southern Pines From Rainfall, Slope, and Available Soil Moisture,
W83-00769 2I

Water Use by Wheat and Plant Indicators of Available Soil Water,
W83-00828 2I

Water Loss From a Shortgrass Steppe,
W83-00855 2D

Crop Evaporation, Surface Resistance and Soil Water Status,
W83-00856 2I

SOLAR POWER
RO Suppliers Look to Wind and Sun to Power Rural Systems.
W83-00969 3A

SOLAR RADIATION
Daily Patterns of Apparent Photosynthesis and Evapotranspiration in a Developing Winter Wheat Crop,
W83-00823 2D

SOLUBILITY
Studies on Alkaline Earth Sulfites--III. Transient Solubilities and Phase Changes of Calcium Sulfite in Seawater,
W83-00712 3A

SOLUTE TRANSPORT
Laplace Transform Solutions for Solute Transport in Fissured Aquifers,
W83-01027 2F

SOUTH CAROLINA
Effect of Thermal Effluents on Oligochaetes in Keowee Reservoir, South Carolina,
W83-00731 5C

Runoff Water Quality From Dairy Pastures in the Piedmont Region,
W83-00870 5B

SOUTH DAKOTA
Water Resources Data, South Dakota, Water Year 1981.
W83-00999 7C

SOYBEANS
Modeling Soybean Leaf-Water Potentials Under Nonlimiting Soil Water Conditions,
W83-00824 2I

Afternoon Water Deficits and Grain Yields in Old and New Soybean Cultivars,
W83-00837 3F

SPAIN
Aircraft Measurements of Icing in Supercooled and Water Droplet Ice Crystal Clouds,
W83-00948 3B

SPATIAL DISTRIBUTION
Water Deficiency in Dharwad District,
W83-01022 2B

SPECTROMETERS
Measurement of Snow Water Storage in the Lake Superior Basin Using Aerial Gamma-Ray Spectrometry,
W83-00965 7B

SPECTROPHOTOMETRY
Spectrophotometric Determination of Microgram Amounts of Chromium(VI) and Total Chromium in Waste Water,
W83-00768 5A

Spectrophotometric Determination of Sulphide in Water by Re-Extraction and Ligand Exchange Using Chloroform Solutions of Copper Quinolin-8-Olate,
W83-01036 5A

SPECTROSCOPY
A Comparison Study for Determining Dissolved Boron in Natural Water and Geothermal Fluid,
W83-00761 5A

SPILLWAY GATE
Chute Spillway Design Calculations,
W83-00765 8A

SPILLWAYS
Hydraulic Model Study of Choke Canyon Dam Spillway and Stilling Basin,
W83-00918 8A

Hydraulic Model Study of Ute Dam Labyrinth Spillway,
W83-00920 8B

SRI LANKA
The Significance of Natural Environmental Factors in the Distribution of Copper in Potable Waters of Sri-Lanka,
W83-00798 5B

ST. LAWRENCE RIVER
The St. Lawrence River in Winter: Population Structure, Biomass, and Pattern of its Primary and Secondary Food Web Components,
W83-00779 2C

STANDING WATERS
Concepts for the Modelling of the Phosphorus Cycle in Lakes and Reservoirs (Modellvorstellungen uber den Phosphorkreislauf in Stehenden Gewassern),
W83-00971 5C

STATISTICAL ANALYSIS
Application of Multiple Discriminant Analysis on the Analysis of the Correlation Between Macrophyte Vegetation and Water Quality in Running Waters of Central Europe,
W83-00776 5A

STEADY FLOW
Steady Flow in Alluvial Channels,
W83-00940 2E

STEELHEAD
Use of Fish Ventilation Frequency to Estimate Chronically Safe Toxicant Concentrations,
W83-00892 5C

STILLING BASINS
Hydraulic Model Study of Choke Canyon Dam Spillway and Stilling Basin,
W83-00918 8A

STOCHASTIC PROCESS
Stochastic Modelling of Monthly Rainfall,
W83-00910 2B

STORAGE COEFFICIENT
Time of Concentration and Storage Coefficient Values for Illinois Streams,
W83-00986 2A

A Technique for Estimating Time of Concentration and Storage Coefficient Values for Illinois Streams,
W83-00988 2A

STORM RUNOFF
Titanium and Tungsten in Highway Runoff at Pullman, Washington,
W83-00799 5B

STORMS
Rainfall Interstation Correlation Functions IV. On the Occurrence of Zero and Less-Than-Zero Response,
W83-00912 2B

STRATIFICATION
Dynamics of Phytoplankton in the Brackish Water Inlet Pojoviken, Southern Coast of Finland,
W83-00709 2L

Physical Characteristics of an Inshore Area on the Atlantic Coast of Brittany and Their Influence on the Pelagic Ecosystem: The Case of the 'Riviere D'Etel',
W83-00792 2L

STREAM DISCHARGE
A Procedure to Estimate Changes in Fish Populations Caused by Changes in Stream Discharge,
W83-00705 2E

STREAMBEDS
Composition of Modern Stream Sand in a Humid Climate Derived From a Low-Grade Metamorphic and Sedimentary Foreland Fold-Thrust Belt of North Georgia,
W83-00931 2J

STREAMFLOW
Streamflow Anomaly Patterns in the U.S.A. and Southern Canada--1951-1970,
W83-00902 2E

Hydrology of the Prairie Dog Creek Drainage Basin, Rosebud and Big Horn Counties, Montana,
W83-00990 7C

A Method for Estimating the 7-Day, 10-Year Low Flow of Streams in Connecticut,
W83-00991 2E

Streamflow Information for Connecticut with Applications to Land-Use Planning,
W83-00992 3E

STREAMS
Variable Effects of Sediment Addition on Stream Benthos,
W83-00730 4C

An Approach to the Study of Transverse Mixing in Streams,
W83-00909 2E

Sedimentology of Muddy Fine-Grained Channel Deposits in Meandering Streams of the American Middle West,
W83-00933 2J

STRESS
Laboratory Measurements of Reservoir Rock From the Geysers Geothermal Field, California,
W83-00770 8E

SULFATES
Runoff Chemistry at a Mini-Catchment Watered With 'Unpolluted Precipitation,'
W83-00754 5B

Effect of Light Intensity of Sulfate Uptake and Primary Productivity by Natural Freshwater Microplankton Communities and Axenic Algal Cultures,
W83-00778 2H

Electron Flow Via Sulfate Reduction and Methanogenesis in the Anaerobic Hypolimnion of Lake Mendota,
W83-00877 2H

SULFIDE
Spectrophotometric Determination of Sulphide in Water by Re-Extraction and Ligand Exchange Using Chloroform Solutions of Copper Quinolin-8-Olate,
W83-01036 5A

SULFIDES
Determination of Sulphide Ion at Trace Levels by Ethylation and Gas Chromatography,
W83-00805 5A

Metal Sulfides in Estuarine Sediments,
W83-01044 5B

SULFUR
Sulfur Isotopic Composition and Water Chemistry in Water from the High Plains Aquifer, Oklahoma Panhandle and Southwestern Kansas,
W83-00987 2F

SURFACE-GROUNDWATER RELATIONS
Water Temperature Variability as an Indicator of Shallow-Depth Groundwater Behaviour in Limestone Areas in West Malaysia,
W83-01048 2F

SURFACE RESISTANCE
Crop Evaporation, Surface Resistance and Soil Water Status,
W83-00856 2I

SURFACE RUNOFF
Hydrologic Effects of Highway-Deicing Chemicals in Massachusetts--Executive Summary,
W83-01008 4C

SURFACE WATER
Experience With the EEC Directive 75/440 on the Quality of Surface Water for Drinking Water Procurement in the Member States (Erfahrungen Mit Der Eg-Richtlinie 75/440 Uber Die Qualitat Von Oberflachenwasser Fur Die Trink-Wassergewinnung in Den Mitgliedsstaaten),
W83-00771 6F

Water Type and Suitability of Oklahoma Surface Waters for Public Supply and Irrigation. Part 2: Salt Fork Arkansas River and Cimarron River Basins Through 1978,
W83-00989 7C

A Method for Estimating the 7-Day, 10-Year Low Flow of Streams in Connecticut,
W83-00991 2E

Streamflow Information for Connecticut with Applications to Land-Use Planning,
W83-00992 3E

Water Resources Data, Idaho, Water Year 1981--Volume 2. Upper Columbia River Basin and Snake River Basin Below King Hill.
W83-00993 7C

Water Resources Data, Michigan, Water Year 1981.
W83-00994 7C

Water Resources Data, Colorado, Water Year 1981--Volume 1. Missouri River Basin, Arkansas River Basin, and Rio Grande Basin.
W83-00995 7C

Water Resources Data, Colorado, Water Year 1981--Volume 2. Colorado River Basin Above Dolores River.
W83-00996 7C

Water Resources Data, Pennsylvania, Water Year 1981--Volume 3. Ohio River and St. Lawrence River Basin.
W83-00997 7C

Water Resources Data, Pennsylvania, Water Year 1981--Volume 2. Susquehanna and Potomac River Basins.
W83-00998 7C

Water Resources Data, South Dakota, Water Year 1981.
W83-00999 7C

Water Resources Data, Ohio, Water Year 1981--Volume 1. Ohio River Basin.
W83-01000 7C

Water Resources Data, Ohio, Water Year 1981--Volume 2. St. Lawrence River Basin Statewide Project Data.
W83-01001 7C

Water Resources Data, Montana, Water Year 1981--Volume 2. Columbia River Basin.
W83-01002 7C

Water Resources Data, Idaho, Water Year 1981--Volume 1. Great Basin and Snake River Basin above King Hill,
W83-01003 7C

Water-Quality Assessment of the Smith River Drainage Basin, California and Oregon.
W83-01006 7C

SURVEYS
Changes in the Environmental Pollution in the Calcutta-Hooghlyside Industrial Strip of India,
W83-00801 5B

SUSPENDED SOILS
Temporal Variability of Suspended Particulate Concentrations in the New York Bight,
W83-01045 2J

SWAMPS
The Uptake of Phosphate by Carex Species for Oligotrophic to Eutrophic Swamp Habitats,
W83-00874 5B

SWEDEN
The Phosphorus Economy of a Hypertrophic Seepage Lake in Scania, South Sweden Groundwater Influence,
W83-00777 2H

Liming of Acidified Lakes: Induced Long-Term Changes,
W83-00958 5G

Structure and Productivity of Epiphytic Algal Communities on Lobelia Dortmanna L. in Acidified and Limed Lakes,
W83-00959 5G

SWITZERLAND
Control of Pore Water Pressures at the Zervreila Arch Dam (Messen von Porenwasserdruck im Untergrund der Bogenstaumauer Zervreila),
W83-00973 8D

Calculations on a Model for the Future Behaviour of Griesgletscher, Wallis (Modellrechnungen zum Zukunftigen Verhalten des Griesgletschers, Wallis),
W83-00982 2C

Groundwater Management with Process Computers in the Hardhof Groundwater Plant of Zurich Water Supply,
W83-01014 4B

The Water Supply in Switzerland, A Survey of the Structure,
W83-01016 5F

The Water Supply of an Agglomeration Area in Switzerland,
W83-01017 5F

SYRIA
Hydrogeology of the Syrian Steppe and Adjoining Arid Areas,
W83-00726 2F

TAIWAN
Unified Management of Water Supply in Taiwan.
W83-01015 5F

TELEMETRY
Microelectronics - A Decisive Medium for the Realization of Automatic Telemetry Networks for Water Monitoring (Die Mikroelektronik - ein Entscheidendes Mittel bei der Realisierung Automatischer Fermnessnetze zue Gewasseruberwachung),
W83-00975 7A

TEMPERATURE EFFECTS
Seasonal Selection in a Freshwater Heterotrophic Bacterial Community,
W83-00758 2H

Irrigation Scheduling Using Crop Canopy-Air Temperature Difference,
W83-00887 3F

The Significance of Surface Temperature Patterns on the Energy Balance of a Small Lake in the Canadian Shield,
W83-01029 2H

TEMPORAL DISTRIBUTION
Long-Term Variation of Macroinvertebrate Assemblages in Apalachee Bay, Florida,
W83-00845 5C

Temporal Variability of Suspended Particulate Concentrations in the New York Bight,
W83-01045 2J

TENNESSEE
Seasonal Selection in a Freshwater Heterotrophic Bacterial Community,
W83-00758 2H

Formation of Freshwater Fe-Mn Coatings on Gravel and the Behavior of Co60, Sr90, and Cs137 in a Small Watershed,
W83-00788 5B

TEXAS
Mitigating Drought Through Weather Modification: Selected Institutional and Meteorological Issues in Texas; Volume One, Texas Advisory Commission on Intergovernmental Relations,
W83-00914 3B

Mitigating Drought through Weather Modification: Selected Institutional and Meteorological Issues in Texas; Volume Two, Radar Echo Characteristics in the Edwards Plateau - Balcones Escarpment Area of Texas,
W83-00915 3B

Mitigating Drought Through Weather Modification: Selected Institutional and Meteorological Issues in Texas; Volume Three, Precipitation Climatology for the Edwards Plateau Region of Texas,
W83-00916 3B

Mitigating Drought Through Weather Modification: Selected Institutional and Meteorological Issues in Texas; Volume Four, an Objective Study of the Upper-Air Conditions Relating to Precipitation Over the Southeastern Section of the Edwards Plateau in Texas,
W83-00917 3B

Hydraulic Model Study of Choke Canyon Dam Spillway and Stilling Basin,
W83-00918 8A

Appendix to Report of Assessment of Low-Head Hydroelectric Sites in the Western States; Evaluation Reports for Low-Head Hydroelectric Sites, Part IV - Kansas, New Mexico, Oklahoma, and Texas.
W83-00926 8A

Movable-Bed Tidal Inlet Model,
W83-00941 2L

THE NETHERLANDS
Community Metabolism of Intertidal Flats in the Ems-Dollard Estuary,
W83-00702 2L

Conditions for Gradient-Type Dispersive Transport in One-Dimensional Turbidity Averaged Transport Models,
W83-00815 2L

The New 'Prinses Juliana' Water Extraction Plant of the Rhine-Kennemerland Water Transport Company,
W83-01013 5F

THERMAL IMAGERY
The Significance of Surface Temperature Patterns on the Energy Balance of a Small Lake in the Canadian Shield,
W83-01029 2H

THERMAL POLLUTION
Effect of Thermal Effluents on Oligochaetes in Keowee Reservoir, South Carolina,
W83-00731 5C

THERMAL WATER
The Thermal Springs of Bath,
W83-00755 2F

Algerian Thermalism in its Geostructural Setting--How Hydrogeology has Helped in the Elucidation of Algeria's Deep-Seated Structure,
W83-00896 2F

A Layered Thermal-Water Twin Flow System,
W83-00906 2F

Isotopic Identification of Gases of a Deep Origin in French Thermomineral Waters,
W83-01047 2F

Information About the Origin of Thermomineral Waters and Gas by Means of Environmental Isotopes in Eastern Azerbaijan, Iran, and Southeast France,
W83-01050 2K

THERMOCOUPLES
A Screen-Caged Thermcouple Psychrometer and Calibration Chamber for Measurements of Plant and Soil Water Potential,
W83-00827 7B

TIDAL CURRENTS
The Structure of Three-Dimensional Tide-Generating Currents: Experimental Verification of a Theoretical Model,
W83-00817 2L

New Method for Tidal Current Computation,
W83-00939 2L

TIDAL EFFECTS
Salinity Levels and Water Exchange in Gamo Lagoon,
W83-00716 2L

A Comparison Between Vertically Integrated and Multilevel Models of Tidal Dynamics in Channels,
W83-00860 2L

TIDAL FLATS
Community Metabolism of Intertidal Flats in the Ems-Dollard Estuary,
W83-00702 2L

TIDAL HYDRAULICS
Hydromechanics of Tidal Jets,
W83-00938 2L

Movable-Bed Tidal Inlet Model,
W83-00941 2L

TIDAL RIVERS
Water Quality of the Tidal Potomac River and Estuary, Hydrologic Data Report, 1980 Water Year,
W83-00984 7C

TIME-OF-TRAVEL STUDIES
Measurement of Time of Travel and Dispersion in Streams by Dye Tracing,
W83-00985 5B

TIME SERIES ANALYSIS
Stochastic Modelling of Monthly Rainfall,
W83-00910 2B

TITANIUM
Titanium and Tungsten in Highway Runoff at Pullman, Washington,
W83-00799 5B

TOXICITY
Reduction of Toxicity and Mutagenicity of Chlorination Effluents With Sulphur Dioxide,
W83-00764 5D

TRACE LEVELS
Gas Chromatographic Analysis of Trace Hydrocarbon Pollutants in Water Samples,
W83-00800 5A

TRACE METALS
Trace Metal Partitioning in the Aqueous Surface Microlayer of a Salt Marsh,
W83-00814 5B

TRACERS
Determining the Turnover Time of Groundwater Systems With the Aid of Environmental Tracers. 1. Models and Their Applicability,
W83-00908 2F

Measurement of Time of Travel and Dispersion in Streams by Dye Tracing,
W83-00985 5B

TRANSPIRATION
Relating Plant Capacitance to the Water Relations of Pinus Contorta,
W83-00784 2D

TRANSPORTATION
The Importance of Groundwater in the Transportation of Allochthonous Dissolved Organic Matter to the Streams Draining a Small Mountain Basin,
W83-00710 2F

TREE RING ANALYSIS
Reconstruction of Past Ice Conditions in a Hudson Bay Estuary Using Tree Rings,
W83-00766 2C

TREES
Relating Plant Capacitance to the Water Relations of Pinus Contorta,
W83-00784 2D

TROPHIC LEVEL
Nutrients and Phytoplankton in Three Shallow, Fresh-water Lakes of Different Trophic Status in Western Australia,
W83-00739 5C

The Uptake of Phosphate by Carex Species for Oligotrophic to Eutrophic Swamp Habitats,
W83-00874 5B

TROUT
Socioeconomic Value of the Trout Fishery in Lake Taneycomo, Missouri,
W83-00872 6C

TUNGSTEN
Titanium and Tungsten in Highway Runoff at Pullman, Washington,
W83-00799 5B

TURBIDITY
Monte Carlo Study of the Nature of the Underwater Light Field in, and the Relationships Between Optical Properties of, Turbid Yellow Waters,
W83-01011 2H

TURBULENCE
Finite Element Analysis of Horizontal and Vertical Turbulent Diffusion Problems in Lakes,
W83-01040 2H

TURBULENT FLOW
Ebb-Tidal Flow Characteristics Near Inlets,
W83-00859 2L

TURNOVER TIME
Determining the Turnover Time of Groundwater Systems With the Aid of Environmental Tracers. 1. Models and Their Applicability,
W83-00908 2F

U.S. GEOLOGICAL SURVEY PROJECTS
Geological Survey Research 1981.
W83-01010 7C

UNIT HYDROGRAPHS
Time of Concentration and Storage Coefficient Values for Illinois Streams,
W83-00986 2A

UNITED KINGDOM
Records of a Lakes' Life in Time: The Sediments,
W83-00708 5C

The Thermal Springs of Bath,
W83-00755 2F

Kielder Water (UK) Project Has Royal Opening.
W83-01033 8A

UNITED STATES
Streamflow Anomaly Patterns in the U.S.A. and Southern Canada--1951-1970,
W83-00902 2E

Geological Survey Research 1981.
W83-01010 7C

UNSATURATED FLOW
A Physical Model Study of the Storage of Low-Grade Heat in Unsaturated Chalk,
W83-00904 4B

Free Surface and Saturated-Unsaturated Analyses of Borehole Infiltration Tests Above the Water Table,
W83-01038 2G

UNSTEADY FLOW
Unsteady Flow Studies in China,
W83-00936 8B

UPLIFT PRESSURE
Hydrogeology of the Syrian Steppe and Adjoining Arid Areas,
W83-00726 2F

Control of Pore Water Pressures at the Zervreila Arch Dam (Messen von Porenwasserdruck im Untergrund der Bogenstaumauer Zervreila),
W83-00973 8D

UREA
The Distribution of Urea in Lake Yunoko,
W83-00721 5B

US GEOLOGICAL SURVEY
U.S. Geological Survey Activities, Fiscal Year 1981.
W83-01009 7C

UTAH
Appendix to Report on Assessment of Low-Head Hydroelectric Sites in the Western States; Evaluation Reports for Low-Head Hydroelectric Sites, Part III - Idaho and Utah.
W83-00925 8A

Impact of Incremental Surface Soil Depths on Infiltrations Rates, Potential Sediment Losses, and Chemical Water Quality,
W83-00934 2J

VARIABILITY
Chemical Variability in the Tamar Estuary, South-West England,
W83-00807 2L

Temporal and Spatial Variation of Rainfall Anomalies in Africa South of Latitude 22 Deg During the Period of Meteorological Record,
W83-00863 2B

Water Temperature Variability as an Indicator of Shallow-Depth Groundwater Behaviour in Limestone Areas in West Malaysia,
W83-01048 2F

VEGETATION EFFECTS
Seasonal Patterns of Soil Water Recharge and Extraction on Semidesert Ranges,
W83-00932 2G

VERTICAL DISTRIBUTION
Vertical Distribution of Free-Living and Attached Heterotrophic Bacteria in Lake Kizaki,
W83-00718 2H

VIRGINIA
Nutrient Retention and Macroinvertebrate Community Structure in a Small Stream Receiving Sewage Effluent,
W83-00844 5C

Open Ocean Disposal of Materials Dredged from a Highly Industrialized Estuary: An Evaluation of Potential Lethal Effects,
W83-01030 5E

WADI
Hydrogeological Conditions in the Middle East,
W83-00724 2F

WASHINGTON
Daphnia in Lake Washington,
W83-00703 2H

Titanium and Tungsten in Highway Runoff at Pullman, Washington,
W83-00799 5B

Daily Patterns of Apparent Photosynthesis and Evapotranspiration in a Developing Winter Wheat Crop,
W83-00823 2D

Appendix to Report on Assessment of Low-Head Hydroelectric Sites in the Western States; Evaluation Reports for Low-Head Hydroelectric Sites, Part VI - Oregon and Washington.
W83-00928 8A

WASHINGTON SUBURBAN SANITARY COMMISSION
Forecasting Short-Term Revenues for Water and Sewer Utilities,
W83-01042 6D

WASTE DISPOSAL *SPRINKLER IRRIGATION
Removal of Nitrogen and Phosphorus From Untreated Milking-Shed Wastes After Application to Permanent Pasture,
W83-00819 5E

WASTE HEAT
A Physical Model Study of the Storage of Low-Grade Heat in Unsaturated Chalk,
W83-00904 4B

WASTEWATER
Determination of Trace Levels of Quaternary Ammonium Compounds in River Water by Liquid Chromatography With Conductometric Detection,
W83-00841 5A

Free Nickel Ion Concentration in Sewage by an Ion Exchange Column-Equilibration Method,
W83-00842 5A

WASTEWATER ANALYSIS
Spectrophotometric Determination of Microgram Amounts of Chromium(VI) and Total Chromium in Waste Water,
W83-00768 5A

WASTEWATER FACILITIES
Design of Combined Nitrification-Dentrification Plants (Bemessung von Kombinierten Nitrifikations-und Denitrifikationsanlagen),
W83-00786 5D

WASTEWATER IRRIGATION
Maize Culture in Reed Canarygrass Sod to Renovate Municipal Wastewater Effluent,
W83-01024 3C

WASTEWATER POLLUTION
Changes in the Environmental Pollution in the Calcutta-Hooghlyside Industrial Strip of India,
W83-00801 5B

WASTEWATER TREATMENT
Oxygen Concentrations and Elimination of Inorganic Phosphorus and Nitrogen in an Experimental Watercourse Stocked With Emergent Macrophytes,
W83-00843 5D

Methods of Analyzing Quinones in Water and Their Application in Studying the Effects of Hydrophytes on Phenols. Part 5: Elimination of Carcinogenic Amines From Solutions Under the Action of Nitella,
W83-00851 5D

Role of Phosphorus in Activated Sludge,
W83-00861 5D

Cooxidation of Benzo(A)Pyrene and Phenols on Activated Sludges,
W83-00866 5D

Combined Treatment Plant Handles City and Paperboard Mill Effluent,
W83-00893 5D

Activated Sludge,
W83-00943 5D

Biological Waste and Drinking Water Treatment: The Advantages of Bacterial Fixation on a Support,
W83-01018 5F

Water Decontamination Process Improvement Tests and Considerations,
W83-01037 5D

WATER ANALYSIS
A Comparison Study for Determining Dissolved Boron in Natural Water and Geothermal Fluid,
W83-00761 5A

Changes in Quality of Finnish Inland Waters Revealed by Grouping Analysis,
W83-00791 2H

Trace Metal Content in the Lalbag Pond of Baroda City Near the Highway,
W83-00803 5B

Determination of Sulphide Ion at Trace Levels by Ethylation and Gas Chromatography,
W83-00805 5A

Large Bore Coated Columns in Analysis for Trace Organic Pollutants in Water,
W83-00963 5A

U. S. Geological Survey Standard Reference Water Samples for Pesticides,
W83-01005 5G

Evaluation of Factors Affecting the Membrane Filter Technique for Testing Drinking Water,
W83-01019 5A

Quality of Underground Irrigation Waters in Semi-Arid Tract of District Agra. III. Tehsils Bay and Fatehabad,
W83-01023 2K

Spectrophotometric Determination of Sulphide in Water by Re-Extraction and Ligand Exchange Using Chloroform Solutions of Copper Quinolin-8-Olate,
W83-01036 5A

WATER BLANKET TECHNIQUE
Economics of the Water Blanket Technique for Greenhouse Heating,
W83-00762 3C

WATER CIRCULATION
Dynamics of Phytoplankton in the Brackish Water Inlet Pojoviken, Southern Coast of Finland,
W83-00709 2L

Conditions for Gradient-Type Dispersive Transport in One-Dimensional Turbidity Averaged Transport Models,
W83-00815 2L

WATER DEFICIT
Moisture-Sensitive Growth Stages of Dwarf Wheat and Optimal Sequencing of Evapotranspiration Deficits,
W83-00834 3F

Water Deficit Effects on Water Potential, and Water Use of Cowpeas,
W83-00835 2I

Afternoon Water Deficits and Grain Yields in Old and New Soybean Cultivars,
W83-00837 3F

Water Deficiency in Dharwad District,
W83-01022 2B

WATER DEMAND
Socioeconomic Value of the Trout Fishery in Lake Taneycomo, Missouri,
W83-00872 6C

Unified Management of Water Supply in Taiwan.
W83-01015 5F

WATER DEPTH
Nonlinear Diffraction by Eigenfunction Expansions,
W83-00942 8B

WATER DISTRIBUTION
The Design of Looped Water Distribution Networks by Application of Linear Programming (Die Dimensionierung Von Vermaschten Wasserverteilungsnetzen Unter Anwendung Der Linearen Programmierung),
W83-00772 8B

WATER EXCHANGE
Investigation into Water Exchange in Reservoirs of Different Shapes and Different Arrangement of Inlet and Discharge Pipes,
W83-01035 5G

WATER HYACINTH
Synergistic Effect of Gibberellic Acid and Chlorflurenol on 2,4-D With Regard to Water Hyacinth,
W83-00745 4A

WATER LAW
Experience With the EEC Directive 75/440 on the Quality of Surface Water for Drinking Water Procurement in the Member States (Erfahrungen Mit Der Eg-Richtlinie 75/440 Uber Die Qualitat Von Oberflachenwasser Fur Die Trink-Wassergewinnung in Den Mitgliedsstaaten),
W83-00771 6F

WATER LEVEL FLUCTUATIONS
Water-Level Trends, Pumpage, and Chemical Quality in the Cambrian-Ordovician Aquifer in Illinois, 1971-1980,
W83-00947 6D

Groundwater Levels in Nebraska, 1981,
W83-01004 2F

WATER LOSS
Water Loss From a Shortgrass Steppe,
W83-00855 2D

WATER MANAGEMENT
ECE Seminar on Water Utilization Recommends Giving Water Management Policies High Priority.
W83-00796 6D

Unified Management of Water Supply in Taiwan.
W83-01015 5F

A Review of Rainwater Harvesting,
W83-01025 3B

WATER POLLUTION CONTROL
Reducing the Cost of Water Pollution Control Under the Clean Water Act,
W83-00757 6E

ECE Water Committee Recommends Declaration on Water Pollution.
W83-00797 5G

The Politics of Water Pollution Control: A Case Study of the Canadian Fisheries Act Amendments and the Pulp and Paper Effluent Regulations, 1970,
W83-00951 6E

Vulnerability Maps: A Promising Tool in Groundwater Protection,
W83-01012 5G

Diffused Type Pollution Control for Catchment Areas of Rivers Used to Provide Drinking Water,
W83-01031 5G

WATER POLLUTION EFFECTS
A Field Study of Estuarine Pollution in Madras, India,
W83-00881 5B

Use of Fish Ventilation Frequency to Estimate Chronically Safe Toxicant Concentrations,
W83-00892 5C

Heavy Metals Pollution of the Upper Arkansas River, Colorado, and its Effects on the Distribution of the Aquatic Macrofauna,
W83-00921 5C

Biological, Chemical and Physical Responses of Lakes to Experimental Acidification,
W83-00957 5C

Effects of Experimental Acidification on Macroinvertebrate Drift Diversity in a Mountain Stream,
W83-00967 5C

WATER POLLUTION PREVENTION
The Development of the Salt Problem in the Rhine in the 60's and 70's (Die Entwicklung des Salz-Problems am Rhein in den 60er und 70er Jahren).
W83-00785 5G

ECE Seminar on Water Utilization Recommends Giving Water Management Policies High Priority.
W83-00796 6D

ECE Water Committee Recommends Declaration on Water Pollution.
W83-00797 5G

Vulnerability Maps: A Promising Tool in Groundwater Protection,
W83-01012 5G

WATER POLLUTION SOURCES
Ecological Effects of Mine Effluents on the South Esk River, North-Eastern Tasmania, II. Trace Metals,
W83-00832 5B

Runoff Water Quality From Dairy Pastures in the Piedmont Region,
W83-00870 5B

Estuarine Metal Monitoring in Southern Brazil,
W83-00880 5B

A Field Study of Estuarine Pollution in Madras, India,
W83-00881 5B

The Use of Calibrated Lakes and Watersheds for Estimating Atmospheric Deposition Near a Large Point Source,
W83-00953 5B

WATER POLLUTION TREATMENT
The Development of the Salt Problem in the Rhine in the 60's and 70's (Die Entwicklung des Salz-Problems am Rhein in den 60er und 70er Jahren).
W83-00785 5G

WATER POTENTIAL
Modeling Soybean Leaf-Water Potentials Under Nonlimiting Soil Water Conditions,
W83-00824 2I

Afternoon Water Deficits and Grain Yields in Old and New Soybean Cultivars,
W83-00837 3F

WATER POTENTIALS
A Screen-Caged Thermcouple Psychrometer and Calibration Chamber for Measurements of Plant and Soil Water Potential,
W83-00827 7B

WATER-PRODUCTION FUNCTIONS
Yield of Alfalfa and Cotton as Influenced by Irrigation,
W83-00836 3F

WATER PROPERTIES
Limnology of Shallow Lakes and Reservoirs (Limnologie Flacher Seen und Talsperren),
W83-00981 2H

WATER QUALITY
Biotic Index Tested for Ability to Assess Water Quality of Missouri Ozark Streams,
W83-00728 5A

Application of Multiple Discriminant Analysis on the Analysis of the Correlation Between Macrophyte Vegetation and Water Quality in Running Waters of Central Europe,
W83-00776 5A

Effects of Stream-Crossing by a Pipeline on the Benthic Macroinvertebrate Communities of a Small Mountain Stream,
W83-00789 5C

Changes in Quality of Finnish Inland Waters Revealed by Grouping Analysis,
W83-00791 2H

Primary Productivity in Relation to the Abiotic Factors in a Temporary Freshwater Pond,
W83-00854 2H

Runoff Water Quality From Dairy Pastures in the Piedmont Region,
W83-00870 5B

Heavy Metals Pollution of the Upper Arkansas River, Colorado, and its Effects on the Distribution of the Aquatic Macrofauna,
W83-00921 5C

Impact of Incremental Surface Soil Depths on Infiltrations Rates, Potential Sediment Losses, and Chemical Water Quality,
W83-00934 2J

Water-Level Trends, Pumpage, and Chemical Quality in the Cambrian-Ordovician Aquifer in Illinois, 1971-1980,
W83-00947 6D

Water Quality of the Tidal Potomac River and Estuary, Hydrologic Data Report, 1980 Water Year,
W83-00984 7C

Water Type and Suitability of Oklahoma Surface Waters for Public Supply and Irrigation. Part 2: Salt Fork Arkansas River and Cimarron River Basins Through 1978,
W83-00989 7C

Water Resources Data, Idaho, Water Year 1981--Volume 2. Upper Columbia River Basin and Snake River Basin Below King Hill.
W83-00993 7C

Water Resources Data, Michigan, Water Year 1981.
W83-00994 7C

Water Resources Data, Colorado, Water Year 1981--Volume 1. Missouri River Basin, Arkansas River Basin, and Rio Grande Basin.
W83-00995 7C

Water Resources Data, Colorado, Water Year 1981--Volume 2. Colorado River Basin Above Dolores River.
W83-00996 7C

Water Resources Data, Pennsylvania, Water Year 1981--Volume 3. Ohio River and St. Lawrence River Basin.
W83-00997 7C

Water Resources Data, Pennsylvania, Water Year 1981--Volume 2. Susquehanna and Potomac River Basins.
W83-00998 7C

Water Resources Data, South Dakota, Water Year 1981.
W83-00999 7C

Water Resources Data, Ohio, Water Year 1981--Volume 1. Ohio River Basin.
W83-01000 7C

Water Resources Data, Ohio, Water Year 1981--Volume 2. St. Lawrence River Basin Statewide Project Data.
W83-01001 7C

Water Resources Data, Montana, Water Year 1981--Volume 2. Columbia River Basin.
W83-01002 7C

Water Resources Data, Idaho, Water Year 1981--Volume 1. Great Basin and Snake River Basin above King Hill,
W83-01003 7C

Water-Quality Assessment of the Smith River Drainage Basin, California and Oregon.
W83-01006 7C

Hydrologic Effects of Highway-Deicing Chemicals in Massachusetts--Executive Summary,
W83-01008 4C

Quality of Underground Irrigation Waters in Semi-Arid Tract of District Agra. III. Tehsils Bay and Fatehabad,
W83-01023 2K

WATER QUALITY CONTROL

Experience With the EEC Directive 75/440 on the Quality of Surface Water for Drinking Water Procurement in the Member States (Erfahrungen Mit Der Eg-Richtlinie 75/440 Uber Die Qualitat Von Oberflachenwasser Fur Die Trink-Wassergewinnung in Den Mitgliedsstaaten),
W83-00771 6F

ECE Seminar on Water Utilization Recommends Giving Water Management Policies High Priority.
W83-00796 6D

ECE Water Committee Recommends Declaration on Water Pollution.
W83-00797 5G

Microelectronics - A Decisive Medium for the Realization of Automatic Telemetry Networks for Water Monitoring (Die Mikroelektronik - ein Entscheidendes Mittel bei der Realisierung Automatischer Fermnessnetze zue Gewasseruberwachung),
W83-00975 7A

Investigation into Water Exchange in Reservoirs of Different Shapes and Different Arrangement of Inlet and Discharge Pipes,
W83-01035 5G

WATER QUALITY STANDARDS

Expanded Criteria for the Assessment of Water Quality in running Waters (Erweiterte Kriterien zue Beurteilung der Wasserbeschaffenheit in Fliessgewassern),
W83-00977 6F

U. S. Geological Survey Standard Reference Water Samples for Pesticides,
W83-01005 5G

WATER RESOURCES DEVELOPMENT

Federal Non-Reserved Water Rights: Fact or Fiction.,
W83-00767 6E

Water From Power: Water Supply and Regional Growth in the Santa Clara Valley,
W83-00795 6D

The New 'Prinses Juliana' Water Extraction Plant of the Rhine-Kennemerland Water Transport Company,
W83-01013 5F

Groundwater Management with Process Computers in the Hardhof Groundwater Plant of Zurich Water Supply,
W83-01014 4B

Unified Management of Water Supply in Taiwan.
W83-01015 5F

The Water Supply of an Agglomeration Area in Switzerland,
W83-01017 5F

Kielder Water (UK) Project Has Royal Opening.
W83-01033 8A

WATER RESOURCES MANAGEMENT

The Water Supply in Switzerland, A Survey of the Structure,
W83-01016 5F

WATER REUSE

ECE Seminar on Water Utilization Recommends Giving Water Management Policies High Priority.
W83-00796 6D

WATER RIGHTS

Federal Non-Reserved Water Rights: Fact or Fiction.,
W83-00767 6E

The Performance of Appropriative Water Rights Systems in the Western United States During Drought,
W83-00882 6E

WATER SAMPLING

U. S. Geological Survey Standard Reference Water Samples for Pesticides,
W83-01005 5G

WATER STORAGE

Relating Plant Capacitance to the Water Relations of Pinus Contorta,
W83-00784 2D

WATER STRESS

Predicting the Effects of Drainage Systems on Corn Yields,
W83-00748 4A

Drought Sensitivity at Various Growth Stages of Barley in Relation to Relative Evapotranspiration and Water Stress,
W83-00838 3F

Effects of Repeated Application of Water Stress on Water Status and Growth of Wheat,
W83-00875 2I

WATER SUPPLY

The Performance of Appropriative Water Rights Systems in the Western United States During Drought,
W83-00882 6E

Full Marks for Oxfam's Water Supply Package.
W83-00968 5F

Desalter Systems for Man-Made Islands,
W83-00979 3A

Clear Water from Coastal Fogs.
W83-00980 3B

Water Type and Suitability of Oklahoma Surface Waters for Public Supply and Irrigation. Part 2: Salt Fork Arkansas River and Cimarron River Basins Through 1978,
W83-00989 7C

The New 'Prinses Juliana' Water Extraction Plant of the Rhine-Kennemerland Water Transport Company,
W83-01013 5F

Groundwater Management with Process Computers in the Hardhof Groundwater Plant of Zurich Water Supply,
W83-01014 4B

The Water Supply in Switzerland, A Survey of the Structure,
W83-01016 5F

The Water Supply of an Agglomeration Area in Switzerland,
W83-01017 5F

Investigation into Water Exchange in Reservoirs of Different Shapes and Different Arrangement of Inlet and Discharge Pipes,
W83-01035 5G

WATER TABLE

Free Surface and Saturated-Unsaturated Analyses of Borehole Infiltration Tests Above the Water Table,
W83-01038 2G

WATER TABLE FLUCTUATIONS
Effect of an Ephemeral Stream on the Groundwater Level and Groundwater Quality in an Arid Zone of India,
W83-00897 4B

WATER TABLE PROFILES
A Nonlinear Optimisation Method for Aquifer Parameter Estimation.
W83-00905 2F

WATER TEMPERATURE
On the Heat Exchange Between Rivers and Atmosphere,
W83-00752 2A

Water Temperature Variability as an Indicator of Shallow-Depth Groundwater Behaviour in Limestone Areas in West Malaysia,
W83-01048 2F

WATER TRANSPORT
The New 'Prinses Juliana' Water Extraction Plant of the Rhine-Kennemerland Water Transport Company,
W83-01013 5F

WATER TREATMENT
Biological Waste and Drinking Water Treatment: The Advantages of Bacterial Fixation on a Support,
W83-01018 5F

Selection of Antibiotic-Resistant Standard Plate Count Bacteria During Water Treatment,
W83-01020 5F

WATER TREATMENT FACILITIES
Standarization of Equipment and Facilities-An Important Prerequisite for Effective Production of Water-Related Equipment in Comecon Member Countries (Typisierung Von Ausrustugen und Anlagen - Wichtige Voraussetzung fur Eine Effektive Production Wasserwirtschaftlicher Ausrustungen in Den RGW-Mitgliedslandern,
W83-00978 5F

Operations Monitoring System at the Helsinki City Waterworks,
W83-01032 5F

WATER USE
Water Use by Wheat and Plant Indicators of Available Soil Water,
W83-00828 2I

Forecasting Short-Term Revenues for Water and Sewer Utilities,
W83-01042 6D

WATER USE EFFICIENCY
ECE Seminar on Water Utilization Recommends Giving Water Management Policies High Priority.
W83-00796 6D

Daily Patterns of Apparent Photosynthesis and Evapotranspiration in a Developing Winter Wheat Crop,
W83-00823 2D

Comparison of Sprinkler, Trickle, Subsurface, and Furrow Irrigation Methods for Row Crops,
W83-00840 3F

Evapotranspiration Studies on Rice in Relation to Water Use Efficiency,
W83-00868 3F

WATERCOURSE
Oxygen Concentrations and Elimination of Inorganic Phosphorus and Nitrogen in an Experimental Watercourse Stocked With Emergent Macrophytes,
W83-00843 5D

WATERSHEDS
A Model for the Design of Drainage in Flat Agricultural Lands,
W83-00820 4A

The Cation Denudation Rate as a Quantitative Index of Sensitivity of Eastern Canadian Rivers to Acidic Atmospheric Precipitation,
W83-00955 5C

WAVES
Chute Spillway Design Calculations,
W83-00765 8A

Nonlinear Diffraction by Eigenfunction Expansions,
W83-00942 8B

WEATHER FORECASTING
Mitigating Drought Through Weather Modification: Selected Institutional and Meteorological Issues in Texas; Volume Four, an Objective Study of the Upper-Air Conditions Relating to Precipitation Over the Southeastern Section of the Edwards Plateau in Texas,
W83-00917 3B

WEATHER MODIFICATION
Mitigating Drought Through Weather Modification: Selected Institutional and Meteorological Issues in Texas; Volume One, Texas Advisory Commission on Intergovernmental Relations,
W83-00914 3B

Mitigating Drought through Weather Modification: Selected Institutional and Meteorological Issues in Texas; Volume Two, Radar Echo Characteristics in the Edwards Plateau - Balcones Escarpment Area of Texas,
W83-00915 3B

Mitigating Drought Through Weather Modification: Selected Institutional and Meteorological Issues in Texas; Volume Three, Precipitation Climatology for the Edwards Plateau Region of Texas,
W83-00916 3B

Mitigating Drought Through Weather Modification: Selected Institutional and Meteorological Issues in Texas; Volume Four, an Objective Study of the Upper-Air Conditions Relating to Precipitation Over the Southeastern Section of the Edwards Plateau in Texas,
W83-00917 3B

Rainfall Results of the Florida Area Cumulus Experiment, 1970-76,
W83-00962 3B

WEATHER PATTERNS
Streamflow Anomaly Patterns in the U.S.A. and Southern Canada--1951-1970,
W83-00902 2E

WEIRS
Hydraulic Model Study of Ute Dam Labyrinth Spillway,
W83-00920 8B

WELL DESIGN
Construction, Operation and Maintenance of Gravel Wells,
W83-00966 8A

WELLS
The Significance of Natural Environmental Factors in the Distribution of Copper in Potable Waters of Sri-Lanka,
W83-00798 5B

Groundwater Levels in Nebraska, 1981,
W83-01004 2F

WESTERN U.S
Energy Market Impacts of the Legal Definition of Geothermal Energy in the Western United States,
W83-00883 6E

WETLANDS
Goals, Methods and Possibilities for Directing Development of Limnic Ecosystems,
W83-00790 5G

Creation of Wetland Habitats in Northeastern Illinois,
W83-00944 5G

WHEAT
Daily Patterns of Apparent Photosynthesis and Evapotranspiration in a Developing Winter Wheat Crop,
W83-00823 2D

Moisture-Sensitive Growth Stages of Dwarf Wheat and Optimal Sequencing of Evapotranspiration Deficits,
W83-00834 3F

Effects of Repeated Application of Water Stress on Water Status and Growth of Wheat,
W83-00875 2I

WIND
RO Suppliers Look to Wind and Sun to Power Rural Systems.
W83-00969 3A

WISCONSIN
Electron Flow Via Sulfate Reduction and Methanogenesis in the Anaerobic Hypolimnion of Lake Mendota,
W83-00877 2H

Sedimentology of Muddy Fine-Grained Channel Deposits in Meandering Streams of the American Middle West,
W83-00933 2J

WYOMING
Appendix to Report on Assessment of Low-Head Hydroelectric Sites in the Western States; Evaluation Reports for Low-Head Hydroelectric Sites, Part V - Montana and Wyoming.
W83-00927 8A

ZINC
Copper, Zinc, and Cadmium Concentrations of Resident Trout Related to Acid-Mine Wastes,
W83-00862 5B

Use of Fish Ventilation Frequency to Estimate Chronically Safe Toxicant Concentrations,
W83-00892 5C

ZOOPLANKTON
Daphnia in Lake Washington,
W83-00703 2H

The Trophic Response of Ciliated Protozoans in Freshwater Lakes,
W83-00704 5C

AUTHOR INDEX

ABSHER, J.
The Feasibility and Benefits of Reclaiming a Man-Made Lake: A Case Study of Lake Paradise, Mattoon, Illinois,
W83-00945 6B

ADEBISI, A. A.
The Physico-Chemical Hydrology of a Tropical Seasonal River-Upper Ogun River,
W83-00706 2E

AGRAWAL, Y. K.
Trace Metal Content in the Lalbag Pond of Baroda City Near the Highway,
W83-00803 5B

ALBRIGHT, L. J.
Attached and Free-Floating Bacteria in the Fraser River Estuary, British Columbia, Canada,
W83-00879 2L

ALDEN, R. W. III
Open Ocean Disposal of Materials Dredged from a Highly Industrialized Estuary: An Evaluation of Potential Lethal Effects,
W83-01030 5E

ALEXANDER, P. K.
The Performance of Appropriative Water Rights Systems in the Western United States During Drought,
W83-00882 6E

ALFOLDI, L.
A Layered Thermal-Water Twin Flow System,
W83-00906 2F

ALI, A.
A Comparison Between Vertically Integrated and Multilevel Models of Tidal Dynamics in Channels,
W83-00860 2L

ALLEMAN, J. E.
Activated Sludge,
W83-00943 5D

ALLRED, E. R.
Irrigation Scheduling Using Crop Canopy-Air Temperature Difference,
W83-00887 3F

ANDERSSON, I. B.
Liming of Acidified Lakes: Induced Long-Term Changes,
W83-00958 5G

ANDREWS, J. N.
The Thermal Springs of Bath,
W83-00755 2F

ARIYARATNE, U. G. M.
The Significance of Natural Environmental Factors in the Distribution of Copper in Potable Waters of Sri-Lanka,
W83-00798 5B

ARMSTRONG, J. L.
Selection of Antibiotic-Resistant Standard Plate Count Bacteria During Water Treatment,
W83-01020 5F

ASMUSSEN, L.. E.
Sediment-Delivery Ratios for a Small Coastal Plain Agricultural Watershed,
W83-00869 2J

ASTON, S. R.
Local Variability in the Distribution of Windscale Fission Products in Estuarine Sediments,
W83-00810 5B

ATKINSON, L. P.
Natural Fluorescence as a Tracer for Distinguishing Between Piedmont and Coastal Plain River Water in the Nearshore Waters of Georgia and North Carolina,
W83-00857 2L

ATLURI, S. N.
Accuracy of Finite Element Solutions of Navier-Stokes Equations Using a Velocity-Pressure Formulation,
W83-01039 2E

ATWELL, B. J.
The Uptake of Phosphate by Carex Species for Oligotrophic to Eutrophic Swamp Habitats,
W83-00874 5B

AUSTIN, G. L.
The Estimation of Rain From Satellite-Borne Microwave Radiometers,
W83-00876 2B

AYERS, J. F.
Numerical Modeling of Salt-Water Intrusion in the Northern Guam Lens,
W83-00946 4B

BAIN, M.
Aircraft Measurements of Icing in Supercooled and Water Droplet Ice Crystal Clouds,
W83-00948 3B

BAIRD, J. I.
Rating Curves for Rivers With Overbank Flow,
W83-00751 2E

BAKIEWICZ, W.
Hydrogeology of the Umm Er Radhuma Aquifer, Saudi Arabia, With Reference to Fossil Gradients,
W83-00727 2F

BAKKES, G. N.
Galerkin Finite Element Method and the Groundwater Flow Equation: 1. Convergence of the Method,
W83-01041 2F

BALE, A. J.
Chemical Variability in the Tamar Estuary, South-West England,
W83-00807 2L

The Dynamics of Estuarine Manganese Cycling,
W83-00809 2L

BANAT, I. M.
Hydrogen as an Electron Donor for Sulfate-Reducing Bacteria in Slurries of Salt Marsh Sediment,
W83-00701 2L

BARBER, R. T.
Sediment Nutrient Regeneration in Three North Carolina Estuaries,
W83-00811 2L

BARCELONA, M. J.
The Feasibility and Benefits of Reclaiming a Man-Made Lake: A Case Study of Lake Paradise, Mattoon, Illinois,
W83-00945 6B

BARKER, J. A.
Laplace Transform Solutions for Solute Transport in Fissured Aquifers,
W83-01027 2F

BARKO, J. W.
Influence of Potassium Source (Sediment Vs. Open Water) and Sediment Composition on the Growth and Nutrition of a Submersed Freshwater Macrophyte (Hydrilla Verticillata (L.F.)
W83-00830 2I

BARNSTON, A.
Rainfall Results of the Florida Area Cumulus Experiment, 1970-76,
W83-00962 3B

BARTLEIN, P. J.
Streamflow Anomaly Patterns in the U.S.A. and Southern Canada--1951-1970,
W83-00902 2E

BATARD, F.
Isotopic Identification of Gases of a Deep Origin in French Thermomineral Waters,
W83-01047 2F

BAUBRON, J. C.
Isotopic Identification of Gases of a Deep Origin in French Thermomineral Waters,
W83-01047 2F

BAUR, A.
Investigation into Water Exchange in Reservoirs of Different Shapes and Different Arrangement of Inlet and Discharge Pipes,
W83-01035 5G

BAYLY, I. A. E.
Invertebrate Fauna and Ecology of Temporary Pools on Granite Outcrops in Southern Western Australia,
W83-00740 2H

BEASLEY, D. B.
A Monitoring/Modeling Strategy for 208 Implementation,
W83-00890 5B

BEAVER, J. R.
The Trophic Response of Ciliated Protozoans in Freshwater Lakes,
W83-00704 5C

BECKER, A.
Computer-Supported Flood Predictions for the Improvement of flood Protection in the DDR (Rechnergestutzte Hochwasservorhersagen zue Verbesserung des Hochwasserschutzes in der DDR),
W83-00976 2E

BELL, C. R.
Attached and Free-Floating Bacteria in the Fraser River Estuary, British Columbia, Canada,
W83-00879 2L

BELYKH, L. I.
Transformation of Benzo(a)pyrene in a Mixture with Phenols under the Effect of Algae and Their Enzyme Preparations,
W83-00961 5B

BEN-ASHER, J.
A Review of Rainwater Harvesting,
W83-01025 3B

BENFIELD, A. C.
Hydrogeology of the Kufra and Sirte Basins, Eastern Libya,
W83-00725 2F

BENNETT, D. R.
Drainage of an Irrigated Saline Soil in Alberta,
W83-00850 4A

BENQUE, J. P.
New Method for Tidal Current Computation,
W83-00939 2L

BENSON, C. R.
Water-Level Trends, Pumpage, and Chemical Quality in the Cambrian-Ordovician Aquifer in Illinois, 1971-1980,
W83-00947 6D

BERNARD, R.
C-Band Radar for Determining Surface Soil Moisture,
W83-00735 7B

BIELYKH, L. J.
Methods of Analyzing Quinones in Water and Their Application in Studying the Effects of Hydrophytes on Phenols. Part 2: Polarographic Methods of Quinone Analysis,
W83-00864 5A

Methods of Analyzing Quinones in Water and Their Application in Studying the Effects of

BIELYKH, L. J.

Hydrophytes on Phenols. Part 3: Phenol Elimination Under the Action of Aquatic Plants,
W83-00852 5D

Methods of Analyzing Quinones in Water and Their Application in Studying the Effects of Hydrophytes on Phenols. Part 5: Elimination of Carcinogenic Amines From Solutions Under the Action of Nitella,
W83-00851 5D

Methods of Analyzing Quiones in Water and Their Application in Studying the Effects of Hydrophytes on Phenols. Part 1: Quinone Determination With Benzene Sulfinic Acid,
W83-00865 5A

BINDSCHADLER, R. A.
Calculations on a Model for the Future Behaviour of Griesgletscher, Wallis (Modellrechnungen zum Zukunftigen Verhalten des Griesgletschers, Wallis),
W83-00982 2C

BIONDINI, R.
Rainfall Results of the Florida Area Cumulus Experiment, 1970-76,
W83-00962 3B

BJORK, S.
Goals, Methods and Possibilities for Directing Development of Limnic Ecosystems,
W83-00790 5G

BLACK, J. H.
A Physical Model Study of the Storage of Low-Grade Heat in Unsaturated Chalk,
W83-00904 4B

BLANCHARD, S. F.
Water Quality of the Tidal Potomac River and Estuary, Hydrologic Data Report, 1980 Water Year,
W83-00984 7C

BLAVOUX, B.
Information About the Origin of Thermomineral Waters and Gas by Means of Environmental Isotopes in Eastern Azerbaijan, Iran, and Southeast France,
W83-01050 2K

BOEHMKE, J. R.
Heavy Metals Pollution of the Upper Arkansas River, Colorado, and its Effects on the Distribution of the Aquatic Macrofauna,
W83-00921 5C

BOERS, T. M.
A Review of Rainwater Harvesting,
W83-01025 3B

BOHRA, D. N.
Effect of an Ephemeral Stream on the Groundwater Level and Groundwater Quality in an Arid Zone of India,
W83-00897 4B

BOLAND, J. J.
Forecasting Short-Term Revenues for Water and Sewer Utilities,
W83-01042 6D

BOMAR, G.
Mitigating Drought Through Weather Modification: Selected Institutional and Meteorological Issues in Texas; Volume One, Texas Advisory Commission on Intergovernmental Relations,
W83-00914 3B

BONEY, A. D.
Phytoplankton Ecology of the Lake of Menteith, Scotland,
W83-00711 2H

BOORAM, C. V. JR.
Sediment-Delivery Ratios for a Small Coastal Plain Agricultural Watershed,
W83-00869 2J

BOPHME, H.
Expanded Criteria for the Assessment of Water Quality in running Waters (Erweiterte Kriterien zue Beurteilung der Wasserbeschaffenheit in Fliessgewassern),
W83-00977 6F

BOSCH, B.
Isotopic Identification of Gases of a Deep Origin in French Thermomineral Waters,
W83-01047 2F

BOTHA, J. F.
Galerkin Finite Element Method and the Groundwater Flow Equation: 1. Convergence of the Method,
W83-01041 2F

BOURCIER, D. R.
Titanium and Tungsten in Highway Runoff at Pullman, Washington,
W83-00799 5B

BOWLER, D. G.
Removal of Nitrogen and Phosphorus From Untreated Milking-Shed Wastes After Application to Permanent Pasture,
W83-00819 5E

BOWMER, K. H.
Aggregates of Particulate Matter and Aufwuchs on Elodea Canadensis in Irrigation Waters, and Inactivation of Diquat,
W83-00741 4A

BOYER, J. S.
Afternoon Water Deficits and Grain Yields in Old and New Soybean Cultivars,
W83-00837 3F

BOYLE, D. K.
U. S. Geological Survey Standard Reference Water Samples for Pesticides,
W83-01005 5G

BRADDOCK, R. D.
The Three-Parameter Infiltration Equation,
W83-00734 2G

BRADEN, J. B.
Economics of the Water Blanket Technique for Greenhouse Heating,
W83-00762 3C

BRAGA KNAK, R.
Estuarine Metal Monitoring in Southern Brazil,
W83-00880 5B

BRATIANU, C.
Accuracy of Finite Element Solutions of Navier-Stokes Equations Using a Velocity-Pressure Formulation,
W83-01039 2E

BRECK, D.
A Method for the Evaluation of Effluent Quality of Various Mechanical Pulping Processes,
W83-00750 5A

BRIDGE, J. S.
Hydraulic Interpretation of Grain-Size Distributions Using A Physical Model for Bedload Transport,
W83-00929 2J

BRISSAUD, F.
Dispersive Transfer and Pesticide Propagation in a Submerged Rice-Field (Transferts Dispersifs et Propagation de Pesticides Dans un Sol de Riziere Inondee),
W83-00907 5B

BROCK, T. D.
Electron Flow Via Sulfate Reduction and Methanogenesis in the Anaerobic Hypolimnion of Lake Mendota,
W83-00877 2H

BROMLEY, D. W.
Agricultural Runoff as a Nonpoint Externality: A Theoretical Development,
W83-00747 5B

BROWN, L.
Aquatic Distribution and Heterotrophic Degradation of Polycyclic Aromatic Hydrocarbons (PAH) in the Tamar Estuary,
W83-00808 5B

BROWN, R. W.
A Screen-Caged Thermcouple Psychrometer and Calibration Chamber for Measurements of Plant and Soil Water Potential,
W83-00827 7B

BRYANT, G.
Limnology of Heart Lake, Ontario,
W83-00774 2H

BUHR, R.
The Feasibility and Benefits of Reclaiming a Man-Made Lake: A Case Study of Lake Paradise, Mattoon, Illinois,
W83-00945 6B

BUNDGAARD, E.
Design of Combined Nitrification-Dentrification Plants (Bemessung von Kombinierten Nitrifikations-und Denitrifikationsanlagen),
W83-00786 5D

BURDON, D. J.
Hydrogeological Conditions in the Middle East,
W83-00724 2F

BURGESS, W. G.
The Thermal Springs of Bath,
W83-00755 2F

BURTON, A.
Combined Treatment Plant Handles City and Paperboard Mill Effluent,
W83-00893 5D

BURTSCHAK, T. V.
Determination of Geohydraulic Parameters and the Infiltration Capacity of Sand Basins for Artificial Groundwater Enrichment (Bestimmung der Geohydraulischen Parameter und der Infiltrationsleistung von Sandbecken bei Kunstlicher Grundwasseranreicherung),
W83-00983 5G

BUSCH, J. R.
Low-Level Aerial Infrared Images for Inventory of an Irrigated Area,
W83-00733 7B

BYERLEE, J. D.
Laboratory Measurements of Reservoir Rock From the Geysers Geothermal Field, California,
W83-00770 8E

CABLE, D. R.
Seasonal Patterns of Soil Water Recharge and Extraction on Semidesert Ranges,
W83-00932 2G

CAIRNS, M. A.
Use of Fish Ventilation Frequency to Estimate Chronically Safe Toxicant Concentrations,
W83-00892 5C

CALOMIRIS, J. J.
Selection of Antibiotic-Resistant Standard Plate Count Bacteria During Water Treatment,
W83-01020 5F

CAMPBELL, D. O.
Water Decontamination Process Improvement Tests and Considerations,
W83-01037 5D

CANTWELL, F. F.
Free Nickel Ion Concentration in Sewage by an Ion Exchange Column-Equilibration Method,
W83-00842 5A

CARLSON, P. R.
Sediment Nutrient Regeneration in Three North Carolina Estuaries,
W83-00811 2L

CERLING, T. E.
Formation of Freshwater Fe-Mn Coatings on Gravel and the Behavior of Co60, Sr90, and Cs137 in a Small Watershed,
W83-00788 5B

CERVIONE JR, M. A.
Streamflow Information for Connecticut with Applications to Land-Use Planning,
W83-00992 3E

CERVIONE, M. A. JR.
A Method for Estimating the 7-Day, 10-Year Low Flow of Streams in Connecticut,
W83-00991 2E

CHAN, C. H.
Lake Ontario Atmospheric Deposition, 1969-1978,
W83-00954 5B

CHANDRA, S.
A Nonlinear Optimisation Method for Aquifer Parameter Estimation.
W83-00905 2F

CHAPMAN, N. A.
A Physical Model Study of the Storage of Low-Grade Heat in Unsaturated Chalk,
W83-00904 4B

CHEN, M. C.
Nonlinear Diffraction by Eigenfunction Expansions,
W83-00942 8B

CHERVIN, M. B.
Copepod Communities in the Estuary and Coastal Plume of the Hudson River,
W83-00813 2L

Interactions Between Suspended Organic Matter and Copepod Grazing in the Plume of the Hudson River,
W83-00793 2L

CHRISTIANSEN, E. A.
Howe Lake: A Hydrodynamic Blowout Structure,
W83-00847 2H

CHRISTOPHERSEN, N.
Runoff Chemistry at a Mini-Catchment Watered With 'Unpolluted Precipitation,'
W83-00754 5B

Sodium Mobility in a Mini-Catchment Studied With Radioactive Tracers and Artificial Precipitation,
W83-00753 5B

CIHA, A. J.
Daily Patterns of Apparent Photosynthesis and Evapotranspiration in a Developing Winter Wheat Crop,
W83-00823 2D

CLAPP, C. E.
Maize Culture in Reed Canarygrass Sod to Renovate Municipal Wastewater Effluent,
W83-01024 3C

CLARKE, T. L.
Temporal Variability of Suspended Particulate Concentrations in the New York Bight,
W83-01045 2J

CLAUSNITZER, E.
Expanded Criteria for the Assessment of Water Quality in running Waters (Erweiterte Kriterien zue Beurteilung der Wasserbeschaffenheit in Fliessgewassern),
W83-00977 6F

CLEMMENS, A. J.
Evaluating Infiltration for Border Irrigation Models,
W83-01026 3F

CLIFTON, R. J.
The Application of Radioisotopes in the Study of Estuarine Sedimentary Processes,
W83-00818 5B

COATES, D.
On the Introduction of Phytophagous Fishes into Gravity-Flow Irrigation Systems in the Sudan,
W83-00783 4A

COCHARD, J.-C.
Physical Characteristics of an Inshore Area on the Atlantic Coast of Brittany and Their Influence on the Pelagic Ecosystem: The Case of the 'Riviere D'Etel',
W83-00792 2L

COHEN, A.
Studies on Alkaline Earth Sulfites--III. Transient Solubilities and Phase Changes of Calcium Sulfite in Seawater,
W83-00712 3A

COLENUTT, B. A.
Gas Chromatographic Analysis of Trace Hydrocarbon Pollutants in Water Samples,
W83-00800 5A

COLLETT, L. C.
Shallow Dredging as a Strategy for the Control of Sublittoral Macrophytes: A Case Study in Tuggerah Lakes, New South Wales,
W83-00831 5G

COLLINS, A. J.
Shallow Dredging as a Strategy for the Control of Sublittoral Macrophytes: A Case Study in Tuggerah Lakes, New South Wales,
W83-00831 5G

COLLINS, E. D.
Water Decontamination Process Improvement Tests and Considerations,
W83-01037 5D

COLLINS, J. M.
A Screen-Caged Thermcouple Psychrometer and Calibration Chamber for Measurements of Plant and Soil Water Potential,
W83-00827 7B

CONSTANTINO, J.
A Method for the Evaluation of Effluent Quality of Various Mechanical Pulping Processes,
W83-00750 5A

CONTRACTOR, D. N.
Numerical Modeling of Salt-Water Intrusion in the Northern Guam Lens,
W83-00946 4B

COOK, J. C.
Titanium and Tungsten in Highway Runoff at Pullman, Washington,
W83-00799 5B

COSTERTON, J. W.
Heterotrophic Activity and Biodegradation of Labile and Refractory Compounds by Groundwater and Stream Microbial Populations,
W83-01021 2F

COUNCE, D. A.
A Comparison Study for Determining Dissolved Boron in Natural Water and Geothermal Fluid,
W83-00761 5A

COUPE, R. H. JR.
Water Quality of the Tidal Potomac River and Estuary, Hydrologic Data Report, 1980 Water Year,
W83-00984 7C

COWIE, B.
Are New Zealnd Stream Ecosystems Really Different.,
W83-00885 2J

CRISMAN, T. L.
The Trophic Response of Ciliated Protozoans in Freshwater Lakes,
W83-00704 5C

CROUT, R. L.
Physical Processes and Sedimentation on a Broad, Shallow Bank,
W83-00816 2J

CROWTHER, J.
Water Temperature Variability as an Indicator of Shallow-Depth Groundwater Behaviour in Limestone Areas in West Malaysia,
W83-01048 2F

CUNGE, J. A.
New Method for Tidal Current Computation,
W83-00939 2L

CYR, K. A.
A Method for Estimating the 7-Day, 10-Year Low Flow of Streams in Connecticut,
W83-00991 2E

DAI, Z.
Unsteady Flow Studies in China,
W83-00936 8B

DASBERG, S.
Water Deficit Effects on Water Potential, and Water Use of Cowpeas,
W83-00835 2I

DAVEY, J. C.
Hydraulic Properties of a Major Alluval Aquifer: An Isotropic, Inhomogeneous System--Comments,
W83-00899 2F

DAVIES, R. W.
A Device to Measure in Situ Lotic Benthic Metabolism,
W83-00773 5B

DAY, J. B. W.
A Physical Model Study of the Storage of Low-Grade Heat in Unsaturated Chalk,
W83-00904 4B

DAZY, J.
Information About the Origin of Thermomineral Waters and Gas by Means of Environmental Isotopes in Eastern Azerbaijan, Iran, and Southeast France,
W83-01050 2K

DEGUCHI, Y.
Bacterial Flora of the Water and Sediment in the Edo River Mouth (In Japanese),
W83-00781 5C

DEO, S. R.
The Feasibility and Benefits of Reclaiming a Man-Made Lake: A Case Study of Lake Paradise, Mattoon, Illinois,
W83-00945 6B

DILLON, P. J.
The Use of Calibrated Lakes and Watersheds for Estimating Atmospheric Deposition Near a Large Point Source,
W83-00953 5B

DISSANAYAKE, C. B.
The Significance of Natural Environmental Factors in the Distribution of Copper in Potable Waters of Sri-Lanka,
W83-00798 5B

DONNINI, G. P.
Reduction of Toxicity and Mutagenicity of Chlorination Effluents With Sulphur Dioxide,
W83-00764 5D

DOWNING, F.
A Siphon Device for Fractionation of Runoff Samples,
W83-00884 7B

DRAKE, R. J.
Design and Testing of a New Microlysimeter for Leaching Studies,
W83-00821 7B

DRISCOLL, D. M.
Mitigating Drought through Weather Modification: Selected Institutional and Meteorological Issues in Texas; Volume Two, Radar Echo Characteristics in the Edwards Plateau - Balcones Escarpment Area of Texas,
W83-00915 3B

DRONKERS, J.
Conditions for Gradient-Type Dispersive Transport in One-Dimensional Turbidity Averaged Transport Models,
W83-00815 2L

DUGAN, P. J.
Long-Term Variation of Macroinvertebrate Assemblages in Apalachee Bay, Florida,
W83-00845 5C

DYMOND, J.
Raingauge Network Reduction,
W83-00900 7A

EAGLESON, K. W.
Variable Effects of Sediment Addition on Stream Benthos,
W83-00730 4C

EAST, J. W.
Cyclical Relationships Between River Discharge and Chemical Concentration During Flood Events,
W83-01046 2E

ECKSTEIN, Y.
A New Geothermal Anomaly in Nicaragua,
W83-00895 2F

EDMONDSON, W. T.
Daphnia in Lake Washington,
W83-00703 2H

EDMUNDS, W. M.
Hydrogeology of the Kufra and Sirte Basins, Eastern Libya,
W83-00725 2F

The Thermal Springs of Bath,
W83-00755 2F

EISENREICH, S. J.
Total Organic Carbon in Lake Superior Sediments: Comparisons With Hemipelagic and Pelagic Marine Environments,
W83-00878 2H

ELLIS, J.
Chute Spillway Design Calculations,
W83-00765 8A

ENELL, M.
The Phosphorus Economy of a Hypertrophic Seepage Lake in Scania, South Sweden Groundwater Influence,
W83-00777 2H

ERVINE, D. A.
Rating Curves for Rivers With Overbank Flow,
W83-00751 2E

EVANS, J. E.
Total Organic Carbon in Lake Superior Sediments: Comparisons With Hemipelagic and Pelagic Marine Environments,
W83-00878 2H

FABRIZIO, A.
The Los Azufres, Michoacan, Mexico, Geothermal Field,
W83-00903 2F

FEDERLE, T. W.
Evidence of Microbial Succession on Decaying Leaf Litter in an Arctic Lake,
W83-00848 2H

FEUILLET, J.
New Method for Tidal Current Computation,
W83-00939 2L

FINLAYSON, B.
Copper, Zinc, and Cadmium Concentrations of Resident Trout Related to Acid-Mine Wastes,
W83-00862 5B

FINLAYSON, C. M.
Nutrients and Phytoplankton in Three Shallow, Fresh-water Lakes of Different Trophic Status in Western Australia,
W83-00739 5C

FISCHER, J. M.
The Availability of Private Remedies for Acid Rain Damage,
W83-00794 6E

FISHER, J. B.
High Resolution Vertical Profiles of pH in Recent Sediments,
W83-00729 5B

FISHER, T. R.
Sediment Nutrient Regeneration in Three North Carolina Estuaries,
W83-00811 2L

FISHMAN, M. J.
U. S. Geological Survey Standard Reference Water Samples for Pesticides,
W83-01005 5G

FOREMAN, T. L.
Hydraulic Properties of a Major Alluvial Aquifer: An Isotropic, Inhomogeneous System--Reply,
W83-00898 2F

FORNEY, J. L.
The St. Lawrence River in Winter: Population Structure, Biomass, and Pattern of its Primary and Secondary Food Web Components,
W83-00779 2C

FRIEDMAN, L. C.
U. S. Geological Survey Standard Reference Water Samples for Pesticides,
W83-01005 5G

FRIND, E. O.
Seawater Intrusion in Continuous Coastal Aquifer-Aquitard Systems,
W83-01028 2F

FROST, L. R. JR.
Hydrologic Effects of Highway-Deicing Chemicals in Massachusetts--Executive Summary,
W83-01008 4C

FUJITA, M.
Stabilization of Waste-Activated Sludge Through the Anoxic-Aerobic Digestion Process,
W83-00713 5E

FUNAZO, K.
Determination of Sulphide Ion at Trace Levels by Ethylation and Gas Chromatography,
W83-00805 5A

GAHLER, W.
Groundwater Management with Process Computers in the Hardhof Groundwater Plant of Zurich Water Supply,
W83-01014 4B

GANTT, R. E.
Runoff Water Quality From Dairy Pastures in the Piedmont Region,
W83-00870 5B

GARDNER, H. R.
Estimation of Multiple Inflows to a Stream Reach Using Water Chemistry Data,
W83-00722 2E

GARKLAVS, G.
A Technique for Estimating Time of Concentration and Storage Coefficient Values for Illinois Streams,
W83-00988 2A

Time of Concentration and Storage Coefficient Values for Illinois Streams,
W83-00986 2A

GARTON, R. R.
Use of Fish Ventilation Frequency to Estimate Chronically Safe Toxicant Concentrations,
W83-00892 5C

GAYET, J. F.
Aircraft Measurements of Icing in Supercooled and Water Droplet Ice Crystal Clouds,
W83-00948 3B

GEISER, K. M.
Irrigation Scheduling Using Crop Canopy-Air Temperature Difference,
W83-00887 3F

GENDZWILL, D. J.
Howe Lake: A Hydrodynamic Blowout Structure,
W83-00847 2H

GEORGE, R. L.
Hydraulic Model Study of Choke Canyon Dam Spillway and Stilling Basin,
W83-00918 8A

GHETTI, P. F.
Ciliated Protozoa and Water Quality in the Torrente Stirone (Northern Italy),
W83-00749 5C

GIBBS, P. J.
Shallow Dredging as a Strategy for the Control of Sublittoral Macrophytes: A Case Study in Tuggerah Lakes, New South Wales,
W83-00831 5G

GIESECKE, J.
Design and Construction of Flexible Groynes (Entwurf und bau Flexibler Buhnen),
W83-00974 8B

GIFFORD, G. F.
Impact of Incremental Surface Soil Depths on Infiltrations Rates, Potential Sediment Losses, and Chemical Water Quality,
W83-00934 2J

GILLER, K. E.
Status of Aquatic Macrophytes in an Undrained Area of Fen in the Norfolk Broads, England,
W83-00746 5C

GITLIN, H. M.
Drip Irrigation Lateral Line Network Design,
W83-00888 3F

GLADNEY, E.
A Comparison Study for Determining Dissolved Boron in Natural Water and Geothermal Fluid,
W83-00761 5A

GOLDSCHMIDT, J. M. E.
Studies on Alkaline Earth Sulfites--III. Transient Solubilities and Phase Changes of Calcium Sulfite in Seawater,
W83-00712 3A

GORDON, D. M.
Nutrients and Phytoplankton in Three Shallow, Fresh-water Lakes of Different Trophic Status in Western Australia,
W83-00739 5C

GRAF, J. B.
A Technique for Estimating Time of Concentration and Storage Coefficient Values for Illinois Streams,
W83-00988 2A

GRAF, J. V.
Time of Concentration and Storage Coefficient Values for Illinois Streams,
W83-00986 2A

GRALL, J.-R.
Physical Characteristics of an Inshore Area on the Atlantic Coast of Brittany and Their Influ-

ence on the Pelagic Ecosystem: The Case of the 'Riviere D'Etel',
W83-00792 2L

GREEN, G. C.
Water Use by Wheat and Plant Indicators of Available Soil Water,
W83-00828 2I

GREGORY, J. M.
Time of Concentration Determination for Small Watersheds,
W83-00871 2A

GRIEDRICH, G.
Limnology of Shallow Lakes and Reservoirs (Limnologie Flacher Seen und Talsperren),
W83-00981 2H

GRIFFIN, R. C.
Agricultural Runoff as a Nonpoint Externality: A Theoretical Development,
W83-00747 5B

GRULICH, G.
Expanded Criteria for the Assessment of Water Quality in running Waters (Erweiterte Kriterien zue Beurteilung der Wasserbeschaffenheit in Fliessgewassern),
W83-00977 6F

GUPTA, R. S.
Environmental Characteristics of the Mandovi-Zuari Estuarine System in Goa,
W83-00804 2L

GUTHLEIN, K.
Computer-Supported Flood Predictions for the Improvement of flood Protection in the DDR (Rechnergestutzte Hochwasservorhersagen zue Verbesserung des Hochwasserschutzes in der DDR),
W83-00976 2E

GUTIERREZ, N. A.
The Los Azufres, Michoacan, Mexico, Geothermal Field,
W83-00903 2F

HAAS, M. A.
Socioeconomic Value of the Trout Fishery in Lake Taneycomo, Missouri,
W83-00872 6C

HAASNOOT, J. J.
The New 'Prinses Juliana' Water Extraction Plant of the Rhine-Kennemerland Water Transport Company,
W83-01013 5F

HAFNER, E.
Design and Construction of Flexible Groynes (Entwurf und bau Flexibler Buhnen),
W83-00974 8B

HALL, D. H.
A Physical Model Study of the Storage of Low-Grade Heat in Unsaturated Chalk,
W83-00904 4B

HALL, R. J.
Effects of Experimental Acidification on Macroinvertebrate Drift Diversity in a Mountain Stream,
W83-00967 5C

HAMILTON, E. I.
The Application of Radioisotopes in the Study of Estuarine Sedimentary Processes,
W83-00818 5B

HAMMOND, R. R.
Seabed Drifter Movement in San Diego Bay and Adjacent Waters,
W83-00738 2L

HANAWA, K.
Salinity Levels and Water Exchange in Gamo Lagoon,
W83-00716 2L

HANNUS, M.
Cooxidation of Benzo(A)Pyrene and Phenols on Activated Sludges,
W83-00866 5D

HANSON, D. W.
Modern and Paleolimnological Evidence for Accelerated Leaching and Metal Accumulation in Soils in New England, Caused by Atmospheric Deposition,
W83-00956 5B

HANYA, T.
The Distribution of Urea in Lake Yunoko,
W83-00721 5B

HARAGAN, D. R.
Mitigating Drought Through Weather Modification: Selected Institutional and Meteorological Issues in Texas; Volume One, Texas Advisory Commission on Intergovernmental Relations,
W83-00914 3B

Mitigating Drought Through Weather Modification: Selected Institutional and Meteorological Issues in Texas; Volume Three, Precipitation Climatology for the Edwards Plateau Region of Texas,
W83-00916 3B

HARDJOAMIDJOJO, S.
Predicting the Effects of Drainage Systems on Corn Yields,
W83-00748 4A

HARKER, D. B.
Drainage of an Irrigated Saline Soil in Alberta,
W83-00850 4A

HARRISON, D. S.
Evapotranspiration Studies on Rice in Relation to Water Use Efficiency,
W83-00868 3F

HASHIMOTO, S.
Stabilization of Waste-Activated Sludge Through the Anoxic-Aerobic Digestion Process,
W83-00713 5E

HAUGUEL, A.
New Method for Tidal Current Computation,
W83-00939 2L

HAWXBY, K.
The Effects of Nutrient, pH and Herbicide Levels on Algal Growth,
W83-00707 5C

HAZELWOOD, D. H.
Biotic Index Tested for Ability to Assess Water Quality of Missouri Ozark Streams,
W83-00728 5A

HEATON, R.
Desalter Systems for Man-Made Islands,
W83-00979 3A

HEATWOLE, C. D.
Finite Element Model to Describe Overland Flow on an Infiltrating Watershed,
W83-00867 2E

HEGG, R. O.
Runoff Water Quality From Dairy Pastures in the Piedmont Region,
W83-00870 5B

HEILEMANN, G.
Standarization of Equipment and Facilities-An Important Prerequisite for Effective Production of Water-Related Equipment in Comecon Member Countries (Typisierung Von Ausrustugen und Anlagen - Wichtige Voraussetzung fur Eine Effektive Production Wasserwirtschaftlicher Ausrustungen in Den RGW-Mitgliedslandern,
W83-00978 5F

HENRY, W. K.
Mitigating Drought Through Weather Modification: Selected Institutional and Meteorological Issues in Texas; Volume Four, an Objective Study of the Upper-Air Conditions Relating to Precipitation Over the Southeastern Section of the Edwards Plateau in Texas,
W83-00917 3B

HENZE, M.
Design of Combined Nitrification-Dentrification Plants (Bemessung von Kombinierten Nitrifikations-und Denitrifikationsanlagen),
W83-00786 5D

HERRGESELL, P. L.
Limnology of a Eutrophic Reservoir: Big Bear Lake, California,
W83-00846 5C

HEURTEAUX, P.
Dispersive Transfer and Pesticide Propagation in a Submerged Rice-Field (Transferts Dispersifs et Propagation de Pesticides Dans un Sol de Riziere Inondee),
W83-00907 5B

HEY, D. L.
Creation of Wetland Habitats in Northeastern Illinois,
W83-00944 5G

HILER, E. A.
Incorporating Crop Needs Into Drainage System Design,
W83-00886 3F

HILLEN, L. W.
Nature and Hydrocarbon Content of Blooms of the Alga Botryococcus Braunii Occurring in Australian Freshwater Lakes,
W83-00743 2H

HINDIN, E.
Titanium and Tungsten in Highway Runoff at Pullman, Washington,
W83-00799 5B

HIRASHIMA, T.
Determination of Sulphide Ion at Trace Levels by Ethylation and Gas Chromatography,
W83-00805 5A

HIRES, R.
Metal Sulfides in Estuarine Sediments,
W83-01044 5B

HOLDER, D. A.
A Method for the Evaluation of Effluent Quality of Various Mechanical Pulping Processes,
W83-00750 5A

HOLDSWORTH, P. M.
A Flow-Proportional Sampler for Plot and Lysimeter Studies,
W83-00911 7B

HOLLY, F. M. JR.
New Method for Tidal Current Computation,
W83-00939 2L

HOLTORFF, G.
Steady Flow in Alluvial Channels,
W83-00940 2E

HOPNER, T.
Oxygen Concentrations and Elimination of Inorganic Phosphorus and Nitrogen in an Experimental Watercourse Stocked With Emergent Macrophytes,
W83-00843 5D

HORTON, R.
A Rapid Technique for Obtaining Uniform Water Content Distributions in Unsaturated Soil Columns,
W83-00723 2G

HOSANSKI, J. M.
In Situ Determination of the Hydrothermal Properties of a Deep Fractured Medium by a Single-Well Technique,
W83-01049 2F

HOSMANI, M. M.
Water Deficiency in Dharwad District,
W83-01022 2B

HOUSTON, K. L.
Hydraulic Model Study of Ute Dam Labyrinth Spillway,
W83-00920 8B

HOWARD, K. W. F.
The Value of Iodide as a Parameter in the Chemical Characterisation of Groundwaters,
W83-00901 2F

HOWE, C. W.
The Performance of Appropriative Water Rights Systems in the Western United States During Drought,
W83-00882 6E

HOWLAND, R. J. M.
Chemical Variability in the Tamar Estuary, South-West England,
W83-00807 2L

The Dynamics of Estuarine Manganese Cycling,
W83-00809 2L

HRUDEY, S. E.
Free Nickel Ion Concentration in Sewage by an Ion Exchange Column-Equilibration Method,
W83-00842 5A

HSU, S. A.
Physical Processes and Sedimentation on a Broad, Shallow Bank,
W83-00816 2J

HSU, S. C.
Evaluation of Factors Affecting the Membrane Filter Technique for Testing Drinking Water,
W83-01019 5A

HUBBARD, E. F.
Measurement of Time of Travel and Dispersion in Streams by Dye Tracing,
W83-00985 5B

HUDSPETH, R. T.
Nonlinear Diffraction by Eigenfunction Expansions,
W83-00942 8B

HUGGINS, L. F.
A Monitoring/Modeling Strategy for 208 Implementation,
W83-00890 5B

HULTBERG, H.
Liming of Acidified Lakes: Induced Long-Term Changes,
W83-00958 5G

HUNTZINGER, T. L.
Water Resources Programs of the U.S. Geological Survey Related to Agriculture in Louisiana,
W83-01007 7C

HUSSEIN, M. M.
Large Bore Coated Columns in Analysis for Trace Organic Pollutants in Water,
W83-00963 5A

HYNES, H. B. N.
The Importance of Groundwater in the Transportation of Allochthonous Dissolved Organic Matter to the Streams Draining a Small Mountain Basin,
W83-00710 2F

ICHIMURA, S.
In Situ Growth and Photosynthetic Characteristics of Oscillatoria Mougeotii in the Metalimnetic Layer of the Small Eutrophic Lake Nakanuma,
W83-00714 2H

IMBODEN, D. M
Concepts for the Modelling of the Phosphorus Cycle in Lakes and Reservoirs (Modellvorstellungen uber den Phosphorkreislauf in Stehenden Gewassern),
W83-00971 5C

INGVORSEN, K.
Electron Flow Via Sulfate Reduction and Methanogenesis in the Anaerobic Hypolimnion of Lake Mendota,
W83-00877 2H

IWATSUBO, R. T.
Water-Quality Assessment of the Smith River Drainage Basin, California and Oregon.
W83-01006 7C

JACKSON, R. G. II.
Sedimentology of Muddy Fine-Grained Channel Deposits in Meandering Streams of the American Middle West,
W83-00933 2J

JACOBY, G. C.
Reconstruction of Past Ice Conditions in a Hudson Bay Estuary Using Tree Rings,
W83-00766 2C

JAIN, S. C.
Movable-Bed Tidal Inlet Model,
W83-00941 2L

JAMES, T. R.
Seasonal Selection in a Freshwater Heterotrophic Bacterial Community,
W83-00758 2H

JEFFRIES, D. S.
The Use of Calibrated Lakes and Watersheds for Estimating Atmospheric Deposition Near a Large Point Source,
W83-00953 5B

JENSEN, A. L.
Use of Conventional Fishery Models to Assess Entrainment and Impingement of Three Lake Michigan Fish Species,
W83-00891 8I

JOHNSON, F. A.
Cyclical Relationships Between River Discharge and Chemical Concentration During Flood Events,
W83-01046 2E

JOHNSON, G. V.
Design and Testing of a New Microlysimeter for Leaching Studies,
W83-00821 7B

JOHNSON, M. S.
Groundwater Levels in Nebraska, 1981,
W83-01004 2F

JOHNSON, R. C.
Daily Patterns of Apparent Photosynthesis and Evapotranspiration in a Developing Winter Wheat Crop,
W83-00823 2D

JOHNSON, R. R.
Afternoon Water Deficits and Grain Yields in Old and New Soybean Cultivars,
W83-00837 3F

JOHNSON, T. C.
Total Organic Carbon in Lake Superior Sediments: Comparisons With Hemipelagic and Pelagic Marine Environments,
W83-00878 2H

JOLLIE, W. H.
Combined Treatment Plant Handles City and Paperboard Mill Effluent,
W83-00893 5D

JONES, C. W.
Frost Action in Soil Foundations and Control of Surface Structure Heaving,
W83-00919 8D

JONES, D. A.
Desalter Systems for Man-Made Islands,
W83-00979 3A

JONES, J. R.
Biotic Index Tested for Ability to Assess Water Quality of Missouri Ozark Streams,
W83-00728 5A

JONES, M.
Physical Properties of Great Barrier Reef Lagoon Waters Near Townsville. I. Effects of Burdekin River Floods,
W83-00759 2L

JOP, K.
Ecology of the Forest Stream Lane Bloto in the Niepolomice Forest 1. Chemism of Water and Bottom Sediments and its Changes Under the Influence of Industrial Pollution,
W83-00763 5B

JORDAN, J.
Rainfall Results of the Florida Area Cumulus Experiment, 1970-76,
W83-00962 3B

JOSHI, P. B.
Hydromechanics of Tidal Jets,
W83-00938 2L

JOSHI, S. N.
Water Deficiency in Dharwad District,
W83-01022 2B

JURY, W. A.
Use of Deterministic and Empirical Models to Predict Potential Evapotranspiration in an Advective Environment,
W83-00825 2D

Water Deficit Effects on Water Potential, and Water Use of Cowpeas,
W83-00835 2I

KADEN, S.
Determination of Geohydraulic Parameters and the Infiltration Capacity of Sand Basins for Artificial Groundwater Enrichment (Bestimmung der Geohydraulischen Parameter und der Infiltrationsleistung von Sandbecken bei Kunstlicher Grundwasseranreicherung),
W83-00983 5G

KAMIYAMA, K.
Vertical Distribution of 137-CS and its Accumulation Rate in Lake Sediments,
W83-00780 2J

KANTROWITZ, S.
Mitigating Drought Through Weather Modification: Selected Institutional and Meteorological Issues in Texas; Volume One, Texas Advisory Commission on Intergovernmental Relations,
W83-00914 3B

KARAN, P. P.
Changes in the Environmental Pollution in the Calcutta-Hooghlyside Industrial Strip of India,
W83-00801 5B

KASHINA, N. F.
Methods of Analyzing Quinones in Water and Their Application in Studying the Effects of Hydrophytes on Phenols. Part 2: Polarographic Methods of Quinone Analysis,
W83-00864 5A

Methods of Analyzing Quinones in Water and Their Application in Studying the Effects of Hydrophytes on Phenols. Part 3: Phenol Elimination Under the Action of Aquatic Plants,
W83-00852 5D

Methods of Analyzing Quinones in Water and Their Application in Studying the Effects of Hydrophytes on Phenols. Part 5: Elimination of Carcinogenic Amines From Solutions Under the Action of Nitella,
W83-00851 5D

Methods of Analyzing Quiones in Water and Their Application in Studying the Effects of Hydrophytes on Phenols. Part 1: Quinone Determination With Benzene Sulfinic Acid,
W83-00865 5A

KASHYAP, D.
A Nonlinear Optimisation Method for Aquifer Parameter Estimation.
W83-00905 2F

KASPAR, T. C.
Modeling Soybean Leaf-Water Potentials Under Nonlimiting Soil Water Conditions,
W83-00824 2I

KATO, K.
Diurnal Change of 14C-Glucose Uptake by Epilimnetic Microbes in Lake Kizaki,
W83-00715 2H

Vertical Distribution of Free-Living and Attached Heterotrophic Bacteria in Lake Kizaki,
W83-00718 2H

KAY, R. L. F.
The Thermal Springs of Bath,
W83-00755 2F

KECSKEMETI, M.
Equilibrium Status of Some Mineral Springs in Victoria,
W83-00760 2K

KENNEDY, J. M.
Determination of Trace Levels of Quaternary Ammonium Compounds in River Water by Liquid Chromatography With Conductometric Detection,
W83-00841 5A

KHOURI, J.
Hydrogeology of the Syrian Steppe and Adjoining Arid Areas,
W83-00726 2F

KIERSPE, G. H.
Local Energy Exchanges in a Shallow, Coastal Lagoon: Winter Conditions,
W83-00858 2L

KIKUCHI, E.
Salinity Levels and Water Exchange in Gamo Lagoon,
W83-00716 2L

KILPATRICK, F. A.
Measurement of Time of Travel and Dispersion in Streams by Dye Tracing,
W83-00985 5B

KING, G. K.
Federal Non-Reserved Water Rights: Fact or Fiction.,
W83-00767 6E

KING, L. J.
Water Decontamination Process Improvement Tests and Considerations,
W83-01037 5D

KING, R. D.
Limnology of Perched Lake, South-West Tasmania,
W83-00742 2H

KING, W. D.
An Automatic Recording Raingage Network for a Cloud-Seeding Experiment,
W83-00950 7A

KIRK, J. T. O.
Estimation of the Scattering Coefficient of Natural Waters Using Underwater Irradiance Measurements,
W83-00744 1A

Monte Carlo Study of the Nature of the Underwater Light Field in, and the Relationships Between Optical Properties of, Turbid Yellow Waters,
W83-01011 2H

KIRSO, U. E.
Transformation of Benzo(a)pyrene in a Mixture with Phenols under the Effect of Algae and Their Enzyme Preparations,
W83-00961 5B

KISHORE, R.
Quality of Underground Irrigation Waters in Semi-Arid Tract of District Agra. III. Tehsils Bay and Fatehabad,
W83-01023 2K

KITCHING, R.
Hydrogeology of the Kufra and Sirte Basins, Eastern Libya,
W83-00725 2F

KNAUER, J. B.
Water Decontamination Process Improvement Tests and Considerations,
W83-01037 5D

KNEEBONE, W. R.
Design and Testing of a New Microlysimeter for Leaching Studies,
W83-00821 7B

KOBASHI, T.
Bacterial Flora of the Water and Sediment in the Edo River Mouth (In Japanese),
W83-00781 5C

KOBAYASHI, N.
Sediment Transport on a Gentle Slope Due to Waves,
W83-00937 2J

KOENIGSBUCH, M.
Studies on Alkaline Earth Sulfites--III. Transient Solubilities and Phase Changes of Calcium Sulfite in Seawater,
W83-00712 3A

KOMAR, P. D.
The Applicability of the Gibbs Euation for Grain Settling Velocities to Conditions Other Than Quartz Grains in Water,
W83-00930 2J

KONDRATIEFF, P. F.
Nutrient Retention and Macroinvertebrate Community Structure in a Small Stream Receiving Sewage Effluent,
W83-00844 5C

KOPACHE, M. E.
Limnology of a Eutrophic Reservoir: Big Bear Lake, California,
W83-00846 5C

KOWALIK, P.
Influence of Irrigation of the Development and Yield of Potatoes,
W83-00833 3F

KOYAMA, M.
Vertical Distribution of 137-CS and its Accumulation Rate in Lake Sediments,
W83-00780 2J

KRAFT, F.
Microelectronics - A Decisive Medium for the Realization of Automatic Telemetry Networks for Water Monitoring (Die Mikroelektronik - ein Entscheidendes Mittel bei der Realisierung Automatischer Fermnessnetze zue Gewasseruberwachung),
W83-00975 7A

KRAJEWSKI, J. J.
Metal Sulfides in Estuarine Sediments,
W83-01044 5B

KRAMER, P. J.
Effects of Repeated Application of Water Stress on Water Status and Growth of Wheat,
W83-00875 2I

KROPP, D.
Creation of Wetland Habitats in Northeastern Illinois,
W83-00944 5G

KROTHE, N. C.
Sulfur Isotopic Composition and Water Chemistry in Water from the High Plains Aquifer, Oklahoma Panhandle and Southwestern Kansas,
W83-00987 2F

KUIPER, P. J. C.
The Uptake of Phosphate by Carex Species for Oligotrophic to Eutrophic Swamp Habitats,
W83-00874 5B

KUMAI, M.
Formation of Ice Crystals and Dissipation of Supercooled Fog by Artificial Nucleation, and Variations of Crystal Habit at Early Growth Stages,
W83-00949 3B

KUNTZ, K. W.
Lake Ontario Atmospheric Deposition, 1969-1978,
W83-00954 5B

KURIHARA, Y.
Salinity Levels and Water Exchange in Gamo Lagoon,
W83-00716 2L

KURSO, U.
Cooxidation of Benzo(A)Pyrene and Phenols on Activated Sludges,
W83-00866 5D

LAAKSONEN, R.
Changes in Quality of Finnish Inland Waters Revealed by Grouping Analysis,
W83-00791 2H

LADD, T. I.
Heterotrophic Activity and Biodegradation of Labile and Refractory Compounds by Groundwater and Stream Microbial Populations,
W83-01021 2F

LAHEY, W. L.
Ocean Dumping of Sewage Sludge: The Tide Turns From Protection to Management,
W83-00732 6E

LAKE, P. S.
Ecological Effects of Mine Effluents on the South Esk River, North-Eastern Tasmania, II. Trace Metals,
W83-00832 5B

LAM, D. C. L.
Finite Element Analysis of Horizontal and Vertical Turbulent Diffusion Problems in Lakes,
W83-01040 2H

LAPPALAINEN, V.
Operations Monitoring System at the Helsinki City Waterworks,
W83-01032 5F

LARSON, W. E.
Maize Culture in Reed Canarygrass Sod to Renovate Municipal Wastewater Effluent,
W83-01024 3C

LAUENROTH, W. K.
Water Loss From a Shortgrass Steppe,
W83-00855 2D

LAZAREK, S.
Structure and Productivity of Epiphytic Algal Communities on Lobelia Dortmanna L. in Acidified and Limed Lakes,
W83-00959 5G

LAZURUS, S. S.
Economics of the Water Blanket Technique for Greenhouse Heating,
W83-00762 3C

LE FEVRE, J.
Physical Characteristics of an Inshore Area on the Atlantic Coast of Brittany and Their Influence on the Pelagic Ecosystem: The Case of the 'Riviere D'Etel',
W83-00792 2L

LEDOUX, E.
In Situ Determination of the Hydrothermal Properties of a Deep Fractured Medium by a Single-Well Technique,
W83-01049 2F

LEDREW, E. F.
The Significance of Surface Temperature Patterns on the Energy Balance of a Small Lake in the Canadian Shield,
W83-01029 2H

LEE, D. J.
The Thermal Springs of Bath,
W83-00755 2F

LENAT, D. R.
Variable Effects of Sediment Addition on Stream Benthos,
W83-00730 4C

LEPRINCE, A.
The Use of Bio-Technics in Water Treatment: Feasibility and Performance of Biological Treatment of Nitrates, (In French),
W83-01034 5F

LI, K.
Unsteady Flow Studies in China,
W83-00936 8B

LIKENS, G. E.
Effects of Experimental Acidification on Macroinvertebrate Drift Diversity in a Mountain Stream,
W83-00967 5C

LIN, P. N.
Unsteady Flow Studies in China,
W83-00936 8B

LINDEN, D. R.
Maize Culture in Reed Canarygrass Sod to Renovate Municipal Wastewater Effluent,
W83-01024 3C

LIPE, J.
Mitigating Drought Through Weather Modification: Selected Institutional and Meteorological Issues in Texas; Volume Four, an Objective Study of the Upper-Air Conditions Relating to Precipitation Over the Southeastern Section of the Edwards Plateau in Texas,
W83-00917 3B

LISLE, I.
The Three-Parameter Infiltration Equation,
W83-00734 2G

LITT, A. H.
Daphnia in Lake Washington,
W83-00703 2H

LIVINGSTON, R. J.
Long-Term Variation of Macroinvertebrate Assemblages in Apalachee Bay, Florida,
W83-00845 5C

LLOYD, J. W.
The Value of Iodide as a Parameter in the Chemical Characterisation of Groundwaters,
W83-00901 2F

LOCKNER, D. A.
Laboratory Measurements of Reservoir Rock From the Geysers Geothermal Field, California,
W83-00770 8E

LOIJENS, H. S.
Measurement of Snow Water Storage in the Lake Superior Basin Using Aerial Gamma-Ray Spectrometry,
W83-00965 7B

LOVEJOY, S.
The Estimation of Rain From Satellite-Borne Microwave Radiometers,
W83-00876 2B

LUDWIGS, R. S.
Water-Level Trends, Pumpage, and Chemical Quality in the Cambrian-Ordovician Aquifer in Illinois, 1971-1980,
W83-00947 6D

LUTHER, G. W.
Metal Sulfides in Estuarine Sediments,
W83-01044 5B

LYONS, S. M.
Impact of Incremental Surface Soil Depths on Infiltrations Rates, Potential Sediment Losses, and Chemical Water Quality,
W83-00934 2J

MACGREGOR, A. N.
Removal of Nitrogen and Phosphorus From Untreated Milking-Shed Wastes After Application to Permanent Pasture,
W83-00819 5E

MACK, G. H.
Composition of Modern Stream Sand in a Humid Climate Derived From a Low-Grade Metamorphic and Sedimentary Foreland Fold-Thrust Belt of North Georgia,
W83-00931 2J

MACKAY, D. A. M.
Large Bore Coated Columns in Analysis for Trace Organic Pollutants in Water,
W83-00963 5A

MADONI, P.
Ciliated Protozoa and Water Quality in the Torrente Stirone (Northern Italy),
W83-00749 5C

MALLALIEU, B. D.
Desalter Systems for Man-Made Islands,
W83-00979 3A

MALONE, T. C.
Copepod Communities in the Estuary and Coastal Plume of the Hudson River,
W83-00813 2L

Interactions Between Suspended Organic Matter and Copepod Grazing in the Plume of the Hudson River,
W83-00793 2L

MALOSZEWSKI, P.
Determining the Turnover Time of Groundwater Systems With the Aid of Environmental Tracers. 1. Models and Their Applicability,
W83-00908 2F

MANCZAK, H.
Diffused Type Pollution Control for Catchment Areas of Rivers Used to Provide Drinking Water,
W83-01031 5G

MANN, R.
Temporal Variability of Suspended Particulate Concentrations in the New York Bight,
W83-01045 2J

MANTOURA, R. F. C.
Aquatic Distribution and Heterotrophic Degradation of Polycyclic Aromatic Hydrocarbons (PAH) in the Tamar Estuary,
W83-00808 5B

MARCE, A.
Isotopic Identification of Gases of a Deep Origin in French Thermomineral Waters,
W83-01047 2F

MARGUEREANU, G.
Examination and Evaluation of Biological Degrading of Metal Gluconate Complexes through the Zahn/Wallens Batch Method (Prufung und Bewertung der Biologischen Abbaubarkeit von me Gluconatkomplexen im Standversuch nach Zahn/Wellens),
W83-00972 5D

MARTEN, G. C.
Maize Culture in Reed Canarygrass Sod to Renovate Municipal Wastewater Effluent,
W83-01024 3C

MARTENS, L. A.
Measurement of Time of Travel and Dispersion in Streams by Dye Tracing,
W83-00985 5B

MARTIN, P.
C-Band Radar for Determining Surface Soil Moisture,
W83-00735 7B

MASUDA, N.
Pathway and Distribution of Trace Elements in Lake Vanda, Antarctica,
W83-00756 5B

MATISOFF, G.
High Resolution Vertical Profiles of pH in Recent Sediments,
W83-00729 5B

MATSUNAGA, K.
Studies on the Decompositive Processes of Phytoplanktonic Organic Matter,
W83-00720 2H

MAULOOD, B. K.
Phytoplankton Ecology of the Lake of Menteith, Scotland,
W83-00711 2H

MCCART, P. J.
Effects of Stream-Crossing by a Pipeline on the Benthic Macroinvertebrate Communities of a Small Mountain Stream,
W83-00789 5C

MCCLYMONDS, N. E.
Hydrology of the Prairie Dog Creek Drainage Basin, Rosebud and Big Horn Counties, Montana,
W83-00990 7C

MCCOMB, A. J.
Nutrients and Phytoplankton in Three Shallow, Fresh-water Lakes of Different Trophic Status in Western Australia,
W83-00739 5C

MCDEVITT, P.
Energy Market Impacts of the Legal Definition of Geothermal Energy in the Western United States,
W83-00883 6E

MEHTA, R.
The Effects of Nutrient, pH and Herbicide Levels on Algal Growth,
W83-00707 5C

MELVIN, R. L.
A Method for Estimating the 7-Day, 10-Year Low Flow of Streams in Connecticut,
W83-00991 2E

MENELEY, W. A.
Howe Lake: A Hydrodynamic Blowout Structure,
W83-00847 2H

MERH, S. S.
Trace Metal Content in the Lalbag Pond of Baroda City Near the Highway,
W83-00803 5B

MEYER, W. S.
Water Use by Wheat and Plant Indicators of Available Soil Water,
W83-00828 2I

MEYERSON, A. L.
Metal Sulfides in Estuarine Sediments,
W83-01044 5B

MICHEL, P.
The Water Supply in Switzerland, A Survey of the Structure,
W83-01016 5F

MIEDEMA, D. G.
Frost Action in Soil Foundations and Control of Surface Structure Heaving,
W83-00919 8D

MILLS, E. L.
The St. Lawrence River in Winter: Population Structure, Biomass, and Pattern of its Primary and Secondary Food Web Components,
W83-00779 2C

MILNE, D. M.
Hydrogeology of the Umm Er Radhuma Aquifer, Saudi Arabia, With Reference to Fossil Gradients,
W83-00727 2F

MINDERHOUD, P.
A Model for the Design of Drainage in Flat Agricultural Lands,
W83-00820 4A

MOGENSEN, V. O.
Drought Sensitivity at Various Growth Stages of Barley in Relation to Relative Evapotranspiration and Water Stress,
W83-00838 3F

MONHEIMER, R. H.
Effect of Light Intensity of Sulfate Uptake and Primary Productivity by Natural Freshwater Microplankton Communities and Axenic Algal Cultures,
W83-00778 2H

MONKE, E. J.
A Monitoring/Modeling Strategy for 208 Implementation,
W83-00890 5B

MOORE, D.
Laboratory Measurements of Reservoir Rock From the Geysers Geothermal Field, California,
W83-00770 8E

MORGAN, N.
Copper, Zinc, and Cadmium Concentrations of Resident Trout Related to Acid-Mine Wastes,
W83-00862 5B

MORRIS, A. W.
Chemical Variability in the Tamar Estuary, South-West England,
W83-00807 2L

The Dynamics of Estuarine Manganese Cycling,
W83-00809 2L

MOSES, R. J.
The Performance of Appropriative Water Rights Systems in the Western United States During Drought,
W83-00882 6E

MOSZ, J.
Influence of Irrigation of the Development and Yield of Potatoes,
W83-00833 3F

MOUTONNET, P.
Dispersive Transfer and Pesticide Propagation in a Submerged Rice-Field (Transferts Dispersifs et Propagation de Pesticides Dans un Sol de Riziere Inondee),
W83-00907 5B

MROZ, E. J.
A Comparison Study for Determining Dissolved Boron in Natural Water and Geothermal Fluid,
W83-00761 5A

MRTHY, K. N. K.
Effect of an Ephemeral Stream on the Groundwater Level and Groundwater Quality in an Arid Zone of India,
W83-00897 4B

MULLER, H.
Microelectronics - A Decisive Medium for the Realization of Automatic Telemetry Networks for Water Monitoring (Die Mikroelektronik - ein Entscheidendes Mittel bei der Realisierung Automatischer Fermnessnetze zue Gewasseruberwachung),
W83-00975 7A

MUNIYANDI, K. M.
Algal Dynamics in Relation to Physico-Chemical Factors in a High Altitude Pond of Shillong, India,
W83-00853 2H

MUNOZ LEYVA, J. A.
Spectrophotometric Determination of Sulphide in Water by Re-Extraction and Ligand Exchange Using Chloroform Solutions of Copper Quinolin-8-Olate,
W83-01036 5A

MURRAY, S. P.
Physical Processes and Sedimentation on a Broad, Shallow Bank,
W83-00816 2J

NAGY, L. A.
The Occurrence of Filamentous Fungi in Drinking Water Distribution Systems,
W83-00849 5F

NALEWAJKO, C.
Limnology of Heart Lake, Ontario,
W83-00774 2H

NARAYANA IYENGAR, R.
Stochastic Modelling of Monthly Rainfall,
W83-00910 2B

NASAR, S. A. K.
Primary Productivity in Relation to the Abiotic Factors in a Temporary Freshwater Pond,
W83-00854 2H

NEALE, P. J.
Interactions Between Suspended Organic Matter and Copepod Grazing in the Plume of the Hudson River,
W83-00793 2L

NEDWELL, D. B.
Exchange of Nitrate, and the Products of Bacterial Nitrate Reduction, Between Seawater and Sediments From a U.K. Saltmarsh,
W83-00812 2L

Hydrogen as an Electron Donor for Sulfate-Reducing Bacteria in Slurries of Salt Marsh Sediment,
W83-00701 2L

NEUMAN, S. P.
Free Surface and Saturated-Unsaturated Analyses of Borehole Infiltration Tests Above the Water Table,
W83-01038 2G

NEWCOMBE, C.
A Procedure to Estimate Changes in Fish Populations Caused by Changes in Stream Discharge,
W83-00705 2E

NICHOLS, S. J.
Effect of Thermal Effluents on Oligochaetes in Keowee Reservoir, South Carolina,
W83-00731 5C

NIELSEN, D. R.
A Rapid Technique for Obtaining Uniform Water Content Distributions in Unsaturated Soil Columns,
W83-00723 2G

NIELSEN, J. S.
Free Nickel Ion Concentration in Sewage by an Ion Exchange Column-Equilibration Method,
W83-00842 5A

NIEMI, A.
Dynamics of Phytoplankton in the Brackish Water Inlet Pojoviken, Southern Coast of Finland,
W83-00709 2L

NISHIMURA, M.
Pathway and Distribution of Trace Elements in Lake Vanda, Antarctica,
W83-00756 5B

NOBLE, S.
Columbia River Entrance Channel Ship Motion Study,
W83-00935 8B

NOORI, M.
Hydrogeology of the Umm Er Radhuma Aquifer, Saudi Arabia, With Reference to Fossil Gradients,
W83-00727 2F

NORRIS, R. H.
Ecological Effects of Mine Effluents on the South Esk River, North-Eastern Tasmania, II. Trace Metals,
W83-00832 5B

NORTON, S. A.
Modern and Paleolimnological Evidence for Accelerated Leaching and Metal Accumulation in Soils in New England, Caused by Atmospheric Deposition,
W83-00956 5B

O'TOOLE, J. C.
Design and Testing of a Microlysimeter for Wetland Rice,
W83-00826 2D

OBERG, K. A.
A Technique for Estimating Time of Concentration and Storage Coefficient Values for Illinois Streams,
W83-00988 2A

Time of Concentration and Storage Coefficient Values for Illinois Streams,
W83-00986 2A

OGAWA, Y.
In Situ Growth and Photosynthetic Characteristics of Oscillatoria Mougeotii in the Metalimnetic Layer of the Small Eutrophic Lake Nakanuma,
W83-00714 2H

OGDEN, J. G. III.
Acidification of Nova Scotia Lakes I: Response of Diatom Assemblages in the Halifax Area,
W83-00960 5C

OKRUTNY, M. S.
Role of Phosphorus in Activated Sludge,
W83-00861 5D

OKUDA, S.
Vertical Distribution of 137-CS and its Accumulation Rate in Lake Sediments,
W83-00780 2J

OLIVER, J. W.
Sulfur Isotopic Composition and Water Chemistry in Water from the High Plains Aquifer, Oklahoma Panhandle and Southwestern Kansas,
W83-00987 2F

OLSEN, S. R.
Estimation of Multiple Inflows to a Stream Reach Using Water Chemistry Data,
W83-00722 2E

OLSON, B. H.
The Occurrence of Filamentous Fungi in Drinking Water Distribution Systems,
W83-00849 5F

ORTH, H.
The Design of Looped Water Distribution Networks by Application of Linear Programming (Die Dimensionierung Von Vermaschten Wasserverteilungsnetzen Unter Anwendung Der Linearen Programmierung),
W83-00772 8B

OSBORNE, L. L.
A Device to Measure in Situ Lotic Benthic Metabolism,
W83-00773 5B

OTTO, F.
Design and Construction of Flexible Groynes (Entwurf und bau Flexibler Buhnen),
W83-00974 8B

OWENS, E. H.
Physical Processes and Sedimentation on a Broad, Shallow Bank,
W83-00816 2J

OZSOY, E.
Ebb-Tidal Flow Characteristics Near Inlets,
W83-00859 2L

PACEY, N. R.
The Value of Iodide as a Parameter in the Chemical Characterisation of Groundwaters,
W83-00901 2F

PAI, B.
Quality of Underground Irrigation Waters in Semi-Arid Tract of District Agra. III. Tehsils Bay and Fatehabad,
W83-01023 2K

PARK, W. M.
Distributional Constraints on Acceptance of Nonpoint Pollution Controls,
W83-00829 6C

PARKIN, D. A.
An Automatic Recording Raingage Network for a Cloud-Seeding Experiment,
W83-00950 7A

PARLANGE, J. Y.
The Three-Parameter Infiltration Equation,
W83-00734 2G

PARLOUR, J. W.
The Politics of Water Pollution Control: A Case Study of the Canadian Fisheries Act Amendments and the Pulp and Paper Effluent Regulations, 1970,
W83-00951 6E

PARTON, W. J.
Water Loss From a Shortgrass Steppe,
W83-00855 2D

PASSIOURA, J. B.
The Meaning of Matric Potential,
W83-00964 2I

PATERSON, B. A.
Drainage of an Irrigated Saline Soil in Alberta,
W83-00850 4A

PEDERSON, D. T.
Groundwater Levels in Nebraska, 1981,
W83-01004 2F

PELLENBARG, R.
Trace Metal Partitioning in the Aqueous Surface Microlayer of a Salt Marsh,
W83-00814 5B

PENDER, G.
Chute Spillway Design Calculations,
W83-00765 8A

PENNINGTON, W.
Records of a Lakes' Life in Time: The Sediments,
W83-00708 5C

PENROSE, D. L.
Variable Effects of Sediment Addition on Stream Benthos,
W83-00730 4C

PEPPER, I. L.
Design and Testing of a New Microlysimeter for Leaching Studies,
W83-00821 7B

PERRIN, D. R.
A Comparison Study for Determining Dissolved Boron in Natural Water and Geothermal Fluid,
W83-00761 5A

PHILIPOT, J. M.
Biological Waste and Drinking Water Treatment: The Advantages of Bacterial Fixation on a Support,
W83-01018 5F

PIETERSE, A. H.
Synergistic Effect of Gibberellic Acid and Chlorflurenol on 2,4-D With Regard to Water Hyacinth,
W83-00745 4A

PINGOUD, K.
A Lumped-Parameter Model for Infiltration,
W83-00913 2G

PITTY, A. F.
Water Temperature Variability as an Indicator of Shallow-Depth Groundwater Behaviour in Limestone Areas in West Malaysia,
W83-01048 2F

PODLEJSKI, J.
Dispersive Transfer and Pesticide Propagation in a Submerged Rice-Field (Transferts Dispersifs et Propagation de Pesticides Dans un Sol de Riziere Inondee),
W83-00907 5B

POLLOCK, S. J.
Hydrologic Effects of Highway-Deicing Chemicals in Massachusetts--Executive Summary,
W83-01008 4C

POWELL, H. K. J.
A Siphon Device for Fractionation of Runoff Samples,
W83-00884 7B

PRATT, J. M.
Effects of Experimental Acidification on Macroinvertebrate Drift Diversity in a Mountain Stream,
W83-00967 5C

QASIM, S. Z.
Environmental Characteristics of the Mandovi-Zuari Estuarine System in Goa,
W83-00804 2L

QU, P. H.
Spectrophotometric Determination of Microgram Amounts of Chromium(VI) and Total Chromium in Waste Water,
W83-00768 5A

QVENILD, C.
Sodium Mobility in a Mini-Catchment Studied With Radioactive Tracers and Artificial Precipitation,
W83-00753 5B

RAHI, G. S.
Evapotranspiration Studies on Rice in Relation to Water Use Efficiency,
W83-00868 3F

RAI, L. C.
Algal Dynamics in Relation to Physico-Chemical Factors in a High Altitude Pond of Shillong, India,
W83-00853 2H

RAJ, K. P. S.
Trace Metal Content in the Lalbag Pond of Baroda City Near the Highway,
W83-00803 5B

RATNAM, B. P.
Water Deficiency in Dharwad District,
W83-01022 2B

RAVELO, C. J.
Incorporating Crop Needs Into Drainage System Design,
W83-00886 3F

READMAN, J. W.
Aquatic Distribution and Heterotrophic Degradation of Polycyclic Aromatic Hydrocarbons (PAH) in the Tamar Estuary,
W83-00808 5B

REDDELL, D. L.
Incorporating Crop Needs Into Drainage System Design,
W83-00886 3F

REDDING-COATES, T. A.
On the Introduction of Phytophagous Fishes into Gravity-Flow Irrigation Systems in the Sudan,
W83-00783 4A

REESE, L. E.
Runoff Water Quality From Dairy Pastures in the Piedmont Region,
W83-00870 5B

REGIER, C.
A Device for Rapid Measurement of Rate of Flow From Gated Irrigation Pipe,
W83-00839 3F

REID, P. D
The Significance of Surface Temperature Patterns on the Energy Balance of a Small Lake in the Canadian Shield,
W83-01029 2H

RHEAD, M. M.
Aquatic Distribution and Heterotrophic Degradation of Polycyclic Aromatic Hydrocarbons (PAH) in the Tamar Estuary,
W83-00808 5B

RICHARD, Y.
The Use of Bio-Technics in Water Treatment: Feasibility and Performance of Biological Treatment of Nitrates, (In French),
W83-01034 5F

RIGGIO, B.
Mitigating Drought Through Weather Modification: Selected Institutional and Meteorological Issues in Texas; Volume One, Texas Advisory Commission on Intergovernmental Relations,
W83-00914 3B

RIGLER, F. H.
The Relation Between Fisheries Management and Limnology,
W83-00873 5C

RISLER, J. J.
Isotopic Identification of Gases of a Deep Origin in French Thermomineral Waters,
W83-01047 2F

ROBERTS, G.
A Flow-Proportional Sampler for Plot and Lysimeter Studies,
W83-00911 7B

ROBERTS, H. H.
Physical Processes and Sedimentation on a Broad, Shallow Bank,
W83-00816 2J

ROLINE, R. A.
Heavy Metals Pollution of the Upper Arkansas River, Colorado, and its Effects on the Distribution of the Aquatic Macrofauna,
W83-00921 5C

ROMAN CEBA, M.
Spectrophotometric Determination of Sulphide in Water by Re-Extraction and Ligand Ex-

change Using Chloroform Solutions of Copper Quinolin-8-Olate,
W83-01036 5A

ROORDA, F. A.
Synergistic Effect of Gibberellic Acid and Chlorflurenol on 2,4-D With Regard to Water Hyacinth,
W83-00745 4A

ROSS, B. B.
Finite Element Model to Describe Overland Flow on an Infiltrating Watershed,
W83-00867 2E

ROTHFELDER, M.
Reducing the Cost of Water Pollution Control Under the Clean Water Act,
W83-00757 6E

ROUNICK, J. S.
Are New Zealnd Stream Ecosystems Really Different.,
W83-00885 2J

RUMMEL, W.
Microelectronics - A Decisive Medium for the Realization of Automatic Telemetry Networks for Water Monitoring (Die Mikroelektronik - ein Entscheidendes Mittel bei der Realisierung Automatischer Fermnessnetze zue Gewasseruberwachung),
W83-00975 7A

RUNNING, S. W.
Relating Plant Capacitance to the Water Relations of Pinus Contorta,
W83-00784 2D

RUSSELL, G.
Crop Evaporation, Surface Resistance and Soil Water Status,
W83-00856 2I

RYAN, B. F.
A Model to Derive Precipitation Patterns and Vertical Velocities in Large-Scale Rain Systems,
W83-00894 2B

SAKAMOTO, M.
Diurnal Change of 14C-Glucose Uptake by Epilimnetic Microbes in Lake Kizaki,
W83-00715 2H

Vertical Distribution of Free-Living and Attached Heterotrophic Bacteria in Lake Kizaki,
W83-00718 2H

SAMMIS, T. W.
Comparison of Sprinkler, Trickle, Subsurface, and Furrow Irrigation Methods for Row Crops,
W83-00840 3F

Yield of Alfalfa and Cotton as Influenced by Irrigation,
W83-00836 3F

SARROT-REYNAULD, J.
Information About the Origin of Thermomineral Waters and Gas by Means of Environmental Isotopes in Eastern Azerbaijan, Iran, and Southeast France,
W83-01050 2K

SASMAN, R. T.
Water-Level Trends, Pumpage, and Chemical Quality in the Cambrian-Ordovician Aquifer in Illinois, 1971-1980,
W83-00947 6D

SASTRY, C. V. S.
Utility of Frequency Distribution of Moisture Adequacy in the Selection of Crops for Areas With Marginal Rainfall,
W83-00806 3F

SASTRY, P. S. N.
Utility of Frequency Distribution of Moisture Adequacy in the Selection of Crops for Areas With Marginal Rainfall,
W83-00806 3F

SATOH, Y.
The Distribution of Urea in Lake Yunoko,
W83-00721 5B

SAUPE, S. G.
Afternoon Water Deficits and Grain Yields in Old and New Soybean Cultivars,
W83-00837 3F

SCHAEFER, B. A.
Equilibrium Status of Some Mineral Springs in Victoria,
W83-00760 2K

SCHALEKAMP, H. C. M.
The Water Supply of an Agglomeration Area in Switzerland,
W83-01017 5F

SCHEEIDER, W. A.
The Use of Calibrated Lakes and Watersheds for Estimating Atmospheric Deposition Near a Large Point Source,
W83-00953 5B

SCHINDLER, D. W.
Biological, Chemical and Physical Responses of Lakes to Experimental Acidification,
W83-00957 5C

SCHMID, J.
The Water Supply in Switzerland, A Survey of the Structure,
W83-01016 5F

SCHNITTER, N. J.
Control of Pore Water Pressures at the Zervreila Arch Dam (Messen von Porenwasserdruck im Untergrund der Bogenstaumauer Zervreila),
W83-00973 8D

SEBAUGH, J. L.
Biotic Index Tested for Ability to Assess Water Quality of Missouri Ozark Streams,
W83-00728 5A

SEELIGER, U.
Estuarine Metal Monitoring in Southern Brazil,
W83-00880 5B

SEIDLER, R. J.
Selection of Antibiotic-Resistant Standard Plate Count Bacteria During Water Treatment,
W83-01020 5F

SEIP, H. M.
Sodium Mobility in a Mini-Catchment Studied With Radioactive Tracers and Artificial Precipitation,
W83-00753 5B

SHABMAN, L. A.
Distributional Constraints on Acceptance of Nonpoint Pollution Controls,
W83-00829 6C

SHANHOLTZ, V. O.
Finite Element Model to Describe Overland Flow on an Infiltrating Watershed,
W83-00867 2E

SHARMA, M.
Primary Productivity in Relation to the Abiotic Factors in a Temporary Freshwater Pond,
W83-00854 2H

SHARP, J. M. JR.
Hydraulic Properties of a Major Alluvial Aquifer: An Isotropic, Inhomogeneous System--Reply,
W83-00898 2F

SHATA, A. A.
Hydrogeology of the Great Nubian Sandstone Basin, Egypt,
W83-00736 2F

SHAW, D. E.
An Automatic Recording Raingage Network for a Cloud-Seeding Experiment,
W83-00950 7A

SHEN, N. K.
Spectrophotometric Determination of Microgram Amounts of Chromium(VI) and Total Chromium in Waste Water,
W83-00768 5A

SHERIDAN, J. M.
Sediment-Delivery Ratios for a Small Coastal Plain Agricultural Watershed,
W83-00869 2J

SHERR, E. B.
Carbon Isotope Composition of Organic Seston and Sediments in a Georgia Salt Marsh Estuary,
W83-00787 2L

SHERRARD, J. H.
Activated Sludge,
W83-00943 5D

SHIH, S. F.
Evapotranspiration Studies on Rice in Relation to Water Use Efficiency,
W83-00868 3F

SHONO, T.
Determination of Sulphide Ion at Trace Levels by Ethylation and Gas Chromatography,
W83-00805 5A

SHOULDERS, E.
Predicting Height and Relative Performance of Major Southern Pines From Rainfall, Slope, and Available Soil Moisture,
W83-00769 2I

SHOUSE, P.
Use of Deterministic and Empirical Models to Predict Potential Evapotranspiration in an Advective Environment,
W83-00825 2D

Water Deficit Effects on Water Potential, and Water Use of Cowpeas,
W83-00835 2I

SIEGFRIED, C. A.
Limnology of a Eutrophic Reservoir: Big Bear Lake, California,
W83-00846 5C

SIMMONS, G. M. JR.
Nutrient Retention and Macroinvertebrate Community Structure in a Small Stream Receiving Sewage Effluent,
W83-00844 5C

SIMPSON, J.
Rainfall Results of the Florida Area Cumulus Experiment, 1970-76,
W83-00962 3B

SINGH, D. V.
Quality of Underground Irrigation Waters in Semi-Arid Tract of District Agra. III. Tehsils Bay and Fatehabad,
W83-01023 2K

SIONIT, N.
Effects of Repeated Application of Water Stress on Water Status and Growth of Wheat,
W83-00875 2I

SKAGGS, R. W.
Incorporating Crop Needs Into Drainage System Design,
W83-00886 3F

Predicting the Effects of Drainage Systems on Corn Yields,
W83-00748 4A

SLACK, D. C.
Irrigation Scheduling Using Crop Canopy-Air Temperature Difference,
W83-00887 3F

SMART, M. M.
Biotic Index Tested for Ability to Assess Water Quality of Missouri Ozark Streams,
W83-00728 5A

SMITH, D. A.
Activated Sludge,
W83-00943 5D

SMITH, F. M.
Water Loss From a Shortgrass Steppe,
W83-00855 2D

SMITH, J. R.
How Inhibitors Improve Economics of Scale,
W83-00970 8G

SMITH, N. P.
Local Energy Exchanges in a Shallow, Coastal Lagoon: Winter Conditions,
W83-00858 2L

SMITH, R. E.
The Three-Parameter Infiltration Equation,
W83-00734 2G

SMITH, S. B.
The St. Lawrence River in Winter: Population Structure, Biomass, and Pattern of its Primary and Secondary Food Web Components,
W83-00779 2C

SOMLYODY, L.
An Approach to the Study of Transverse Mixing in Streams,
W83-00909 2E

SONDERSKOV, C.
Vulnerability Maps: A Promising Tool in Groundwater Protection,
W83-01012 5G

SOUSLOV, S. N.
Methods of Analyzing Quinones in Water and Their Application in Studying the Effects of Hydrophytes on Phenols. Part 2: Polarographic Methods of Quinone Analysis,
W83-00864 5A

Methods of Analyzing Quinones in Water and Their Application in Studying the Effects of Hydrophytes on Phenols. Part 3: Phenol Elimination Under the Action of Aquatic Plants,
W83-00852 5D

Methods of Analyzing Quinones in Water and Their Application in Studying the Effects of Hydrophytes on Phenols. Part 5: Elimination of Carcinogenic Amines From Solutions Under the Action of Nitella,
W83-00851 5D

Methods of Analyzing Quiones in Water and Their Application in Studying the Effects of Hydrophytes on Phenols. Part 1: Quinone Determination With Benzene Sulfinic Acid,
W83-00865 5A

SPIGARELLI, S. A.
Use of Conventional Fishery Models to Assess Entrainment and Impingement of Three Lake Michigan Fish Species,
W83-00891 8I

SPOMER, L. A.
Prediction and Control of Porosity and Water Retention in Sand-Soil Mixtures for Drained Turf Sites,
W83-00822 2G

SREENIVASA, M.
Limnology of Heart Lake, Ontario,
W83-00774 2H

SRIDHAR, M. K. C.
A Field Study of Estuarine Pollution in Madras, India,
W83-00881 5B

STANFORD, J. G.
Mitigating Drought Through Weather Modification: Selected Institutional and Meteorological Issues in Texas; Volume One, Texas Advisory Commission on Intergovernmental Relations,
W83-00914 3B

STANG, O.
On the Heat Exchange Between Rivers and Atmosphere,
W83-00752 2A

STANGE, K. W.
Irrigation Scheduling Using Crop Canopy-Air Temperature Difference,
W83-00887 3F

STANLEY, C. S.
Modeling Soybean Leaf-Water Potentials Under Nonlimiting Soil Water Conditions,
W83-00824 2I

STANNERS, D. A.
Local Variability in the Distribution of Windscale Fission Products in Estuarine Sediments,
W83-00810 5B

STEINER, R. C.
Forecasting Short-Term Revenues for Water and Sewer Utilities,
W83-01042 6D

STEPHENS, D. B.
Free Surface and Saturated-Unsaturated Analyses of Borehole Infiltration Tests Above the Water Table,
W83-01038 2G

STEPIEN, J. C.
Copepod Communities in the Estuary and Coastal Plume of the Hudson River,
W83-00813 2L

STEVENSON, D. S.
Unreliabilities of Pressure Plate 1500 Kilopascal Data in Predicting Soil Water Contents at Which Plants Become Wilted in Soil-Peat Mixes,
W83-00782 2G

STOCKDALE, J. M.
Creation of Wetland Habitats in Northeastern Illinois,
W83-00944 5G

STOL, P. T.
Rainfall Interstation Correlation Functions IV. On the Occurrence of Zero and Less-Than-Zero Response,
W83-00912 2B

STOLZY, L. H.
Use of Deterministic and Empirical Models to Predict Potential Evapotranspiration in an Advective Environment,
W83-00825 2D

Water Deficit Effects on Water Potential, and Water Use of Cowpeas,
W83-00835 2I

STOM, D. I.
Transformation of Benzo(a)pyrene in a Mixture with Phenols under the Effect of Algae and Their Enzyme Preparations,
W83-00961 5B

STOM, D. J.
Methods of Analyzing Quinones in Water and Their Application in Studying the Effects of Hydrophytes on Phenols. Part 2: Polarographic Methods of Quinone Analysis,
W83-00864 5A

Methods of Analyzing Quinones in Water and Their Application in Studying the Effects of Hydrophytes on Phenols. Part 3: Phenol Elimination Under the Action of Aquatic Plants,
W83-00852 5D

Methods of Analyzing Quinones in Water and Their Application in Studying the Effects of Hydrophytes on Phenols. Part 5: Elimination of Carcinogenic Amines From Solutions Under the Action of Nitella,
W83-00851 5D

Methods of Analyzing Quiones in Water and Their Application in Studying the Effects of Hydrophytes on Phenols. Part 1: Quinone Determination With Benzene Sulfinic Acid,
W83-00865 5A

STONER, J. D.
Water Type and Suitability of Oklahoma Surface Waters for Public Supply and Irrigation. Part 2: Salt Fork Arkansas River and Cimarron River Basins Through 1978,
W83-00989 7C

STOUT, G. E.
The Feasibility and Benefits of Reclaiming a Man-Made Lake: A Case Study of Lake Paradise, Mattoon, Illinois,
W83-00945 6B

STUANES, A. O.
Runoff Chemistry at a Mini-Catchment Watered With 'Unpolluted Precipitation,'
W83-00754 5B

STUIVER, B.
The Uptake of Phosphate by Carex Species for Oligotrophic to Eutrophic Swamp Habitats,
W83-00874 5B

SUGITA, H.
Bacterial Flora of the Water and Sediment in the Edo River Mouth (In Japanese),
W83-00781 5C

SULLIVAN, R. W.
Construction, Operation and Maintenance of Gravel Wells,
W83-00966 8A

SUMMERS, R.
Laboratory Measurements of Reservoir Rock From the Geysers Geothermal Field, California,
W83-00770 8E

SUZUKI, S.
Distribution of Heavy Metals in Bottom Mud of Rivers VIII. Distribution of Total and Extractable Cd and Zn,
W83-00719 5B

SWAIN, R.
Ecological Effects of Mine Effluents on the South Esk River, North-Eastern Tasmania, II. Trace Metals,
W83-00832 5B

SWALES, S.
Environmental Effects of River Channel Works Used in Land Drainage Improvement,
W83-00952 6G

SWIFT, D. J. P.
Temporal Variability of Suspended Particulate Concentrations in the New York Bight,
W83-01045 2J

SYERS, J. K.
Removal of Nitrogen and Phosphorus From Untreated Milking-Shed Wastes After Application to Permanent Pasture,
W83-00819 5E

SZYMANSKA, H.
Diffused Type Pollution Control for Catchment Areas of Rivers Used to Provide Drinking Water,
W83-01031 5G

TADA, F.
Distribution of Heavy Metals in Bottom Mud of Rivers VIII. Distribution of Total and Extractable Cd and Zn,
W83-00719 5B

TAN, T. O.
Removal of Nitrogen and Phosphorus From Untreated Milking-Shed Wastes After Application to Permanent Pasture,
W83-00819 5E

TANAAMI, H.
Bacterial Flora of the Water and Sediment in the Edo River Mouth (In Japanese),
W83-00781 5C

TANAKA, M.
Determination of Sulphide Ion at Trace Levels by Ethylation and Gas Chromatography,
W83-00805 5A

TAYLOR, H. M.
Modeling Soybean Leaf-Water Potentials Under Nonlimiting Soil Water Conditions,
W83-00824 2I

TEARE, I. D.
Effects of Repeated Application of Water Stress on Water Status and Growth of Wheat,
W83-00875 2I

TEE, K. T.
The Structure of Three-Dimensional Tide-Generating Currents: Experimental Verification of a Theoretical Model,
W83-00817 2L

TELANG, S. A.
The Importance of Groundwater in the Transportation of Allochthonous Dissolved Organic Matter to the Streams Draining a Small Mountain Basin,
W83-00710 2F

TELLAM, J. H.
The Value of Iodide as a Parameter in the Chemical Characterisation of Groundwaters,
W83-00901 2F

TERAI, K.
Stabilization of Waste-Activated Sludge Through the Anoxic-Aerobic Digestion Process,
W83-00713 5E

THIERFELD, D.
Oxygen Concentrations and Elimination of Inorganic Phosphorus and Nitrogen in an Experimental Watercourse Stocked With Emergent Macrophytes,
W83-00843 5D

THOMMES, M. M.
Use of Conventional Fishery Models to Assess Entrainment and Impingement of Three Lake Michigan Fish Species,
W83-00891 8I

THOMPSON, M. E.
The Cation Denudation Rate as a Quantitative Index of Sensitivity of Eastern Canadian Rivers to Acidic Atmospheric Precipitation,
W83-00955 5C

THONY, J. L.
C-Band Radar for Determining Surface Soil Moisture,
W83-00735 7B

THORBURN, S.
Gas Chromatographic Analysis of Trace Hydrocarbon Pollutants in Water Samples,
W83-00800 5A

TIARKS, A. E.
Predicting Height and Relative Performance of Major Southern Pines From Rainfall, Slope, and Available Soil Moisture,
W83-00769 2I

TIEMER, K.
Determination of Geohydraulic Parameters and the Infiltration Capacity of Sand Basins for Artificial Groundwater Enrichment (Bestimmung der Geohydraulischen Parameter und der Infiltrationsleistung von Sandbecken bei Kunstlicher Grundwasseranreicherung),
W83-00983 5G

TIMMS, B. V.
Primary Production in Three Lakes of Differing Salinity in Victoria, Australia,
W83-00775 2H

A Study of the Benthic Communities of Twenty Lakes in the South Island, New Zealand,
W83-00737 2H

TIMOFEEVA, S. S.
Methods of Analyzing Quinones in Water and Their Application in Studying the Effects of Hydrophytes on Phenols. Part 2: Polarographic Methods of Quinone Analysis,
W83-00864 5A

Methods of Analyzing Quinones in Water and Their Application in Studying the Effects of Hydrophytes on Phenols. Part 3: Phenol Elimination Under the Action of Aquatic Plants,
W83-00852 5D

Methods of Analyzing Quinones in Water and Their Application in Studying the Effects of Hydrophytes on Phenols. Part 5: Elimination of Carcinogenic Amines From Solutions Under the Action of Nitella,
W83-00851 5D

Methods of Analyzing Quiones in Water and Their Application in Studying the Effects of Hydrophytes on Phenols. Part 1: Quinone Determination With Benzene Sulfinic Acid,
W83-00865 5A

TIMON, A.
Design and Construction of Flexible Groynes (Entwurf und bau Flexibler Buhnen),
W83-00974 8B

TOLLAN, O.
Sodium Mobility in a Mini-Catchment Studied With Radioactive Tracers and Artificial Precipitation,
W83-00753 5B

TOMAR, V. S.
Design and Testing of a Microlysimeter for Wetland Rice,
W83-00826 2D

TORII, T.
Pathway and Distribution of Trace Elements in Lake Vanda, Antarctica,
W83-00756 5B

TRACY, B. H.
Biotic Index Tested for Ability to Assess Water Quality of Missouri Ozark Streams,
W83-00728 5A

TRENTHAM, J. N.
Seasonal Selection in a Freshwater Heterotrophic Bacterial Community,
W83-00758 2H

TRUEB, E.
The Water Supply in Switzerland, A Survey of the Structure,
W83-01016 5F

TRUJILLO, P. E.
A Comparison Study for Determining Dissolved Boron in Natural Water and Geothermal Fluid,
W83-00761 5A

TSUI, P. T. P.
Effects of Stream-Crossing by a Pipeline on the Benthic Macroinvertebrate Communities of a Small Mountain Stream,
W83-00789 5C

TUBB, R. A.
Use of Fish Ventilation Frequency to Estimate Chronically Safe Toxicant Concentrations,
W83-00892 5C

TUBEA, B.
The Effects of Nutrient, pH and Herbicide Levels on Algal Growth,
W83-00707 5C

TURNER, M. A.
Biological, Chemical and Physical Responses of Lakes to Experimental Acidification,
W83-00957 5C

TURNER, R. R.
Formation of Freshwater Fe-Mn Coatings on Gravel and the Behavior of Co60, Sr90, and Cs137 in a Small Watershed,
W83-00788 5B

TYLER, P. A.
Limnology of Perched Lake, South-West Tasmania,
W83-00742 2H

TYSON, P. D.
Temporal and Spatial Variation of Rainfall Anomalies in Africa South of Latitude 22 Deg During the Period of Meteorological Record,
W83-00863 2B

UCHIYAMA, M.
The Behaviour of Methylene Blue Active Substance (MBAS) in Bottom Muds Under Laboratory Conditions,
W83-00717 2K

ULAN, L. D.
Reconstruction of Past Ice Conditions in a Hudson Bay Estuary Using Tree Rings,
W83-00766 2C

UNDERWOOD, J. K.
Acidification of Nova Scotia Lakes I: Response of Diatom Assemblages in the Halifax Area,
W83-00960 5C

UNLUATA, U.
Ebb-Tidal Flow Characteristics Near Inlets,
W83-00859 2L

UTLEY, T.
Mitigating Drought Through Weather Modification: Selected Institutional and Meteorological Issues in Texas; Volume Four, an Objective Study of the Upper-Air Conditions Relating to Precipitation Over the Southeastern Section of the Edwards Plateau in Texas,
W83-00917 3B

VAN DEN BROEK, W. L. F.
Aspects of the Biology of Estuarine Fish Populations Sampled From Power Station Trash Screens,
W83-00802 5C

VAN ES, F. B.
Community Metabolism of Intertidal Flats in the Ems-Dollard Estuary,
W83-00702 2L

VAUCLIN, M.
C-Band Radar for Determining Surface Soil Moisture,
W83-00735 7B

VAUGHAN, H. H.
Acidification of Nova Scotia Lakes I: Response of Diatom Assemblages in the Halifax Area,
W83-00960 5C

VEERKAMP, M. T.
The Uptake of Phosphate by Carex Species for Oligotrophic to Eutrophic Swamp Habitats,
W83-00874 5B

VENTULLO, R. M.
Heterotrophic Activity and Biodegradation of Labile and Refractory Compounds by Groundwater and Stream Microbial Populations,
W83-01021 2F

VERDEIL, P.
Algerian Thermalism in its Geostructural Setting--How Hydrogeology has Helped in the Elucidation of Algeria's Deep-Seated Structure,
W83-00896 2F

VESTAL, J. R.
Evidence of Microbial Succession on Decaying Leaf Litter in an Arctic Lake,
W83-00848 2H

VICTOR, U. S.
Utility of Frequency Distribution of Moisture Adequacy in the Selection of Crops for Areas With Marginal Rainfall,
W83-00806 3F

VIDAL-MADJAR, D.
C-Band Radar for Determining Surface Soil Moisture,
W83-00735 7B

VILLUMSEN, A.
Vulnerability Maps: A Promising Tool in Groundwater Protection,
W83-01012 5G

VINAGRE JARA, F.
Spectrophotometric Determination of Sulphide in Water by Re-Extraction and Ligand Exchange Using Chloroform Solutions of Copper Quinolin-8-Olate,
W83-01036 5A

VOORHEES, W. B.
Soil Erosion and Runoff From Planting to Canopy Development as Influenced by Tractor Wheel-Traffic,
W83-00889 4D

WAKE, L. V.
Nature and Hydrocarbon Content of Blooms of the Alga Botryococcus Braunii Occurring in Australian Freshwater Lakes,
W83-00743 2H

WAKELEE, R. F.
Hydrologic Effects of Highway-Deicing Chemicals in Massachusetts--Executive Summary,
W83-01008 4C

WALKER, P. N.
Economics of the Water Blanket Technique for Greenhouse Heating,
W83-00762 3C

WALKER, R. A.
Water From Power: Water Supply and Regional Growth in the Santa Clara Valley,
W83-00795 6D

WALLACE, W. J.
Seabed Drifter Movement in San Diego Bay and Adjacent Waters,
W83-00738 2L

WALLIS, P. M.
Heterotrophic Activity and Biodegradation of Labile and Refractory Compounds by Groundwater and Stream Microbial Populations,
W83-01021 2F

The Importance of Groundwater in the Transportation of Allochthonous Dissolved Organic Matter to the Streams Draining a Small Mountain Basin,
W83-00710 2F

WANG, S.
Columbia River Entrance Channel Ship Motion Study,
W83-00935 8B

WASHABAUGH, D. S.
Water-Quality Assessment of the Smith River Drainage Basin, California and Oregon.
W83-01006 7C

WATKINS, J. S.
Frost Action in Soil Foundations and Control of Surface Structure Heaving,
W83-00919 8D

WEARING, J.
A Method for the Evaluation of Effluent Quality of Various Mechanical Pulping Processes,
W83-00750 5A

WEBSTER, G. R.
Drainage of an Irrigated Saline Soil in Alberta,
W83-00850 4A

WEE, V. T.
Determination of Trace Levels of Quaternary Ammonium Compounds in River Water by Liquid Chromatography With Conductometric Detection,
W83-00841 5A

WEI, F. S.
Spectrophotometric Determination of Microgram Amounts of Chromium(VI) and Total Chromium in Waste Water,
W83-00768 5A

WEITHMAN, A. S.
Socioeconomic Value of the Trout Fishery in Lake Taneycomo, Missouri,
W83-00872 6C

WELLS, D.
Energy Market Impacts of the Legal Definition of Geothermal Energy in the Western United States,
W83-00883 6E

WENTWORTH, R. W.
Forecasting Short-Term Revenues for Water and Sewer Utilities,
W83-01042 6D

WEST, R. J.
Shallow Dredging as a Strategy for the Control of Sublittoral Macrophytes: A Case Study in Tuggerah Lakes, New South Wales,
W83-00831 5G

WHEELER, B. D.
Status of Aquatic Macrophytes in an Undrained Area of Fen in the Norfolk Broads, England,
W83-00746 5C

WIEGLEB, G.
Application of Multiple Discriminant Analysis on the Analysis of the Correlation Between Macrophyte Vegetation and Water Quality in Running Waters of Central Europe,
W83-00776 5A

WIERENGA, P. J.
A Rapid Technique for Obtaining Uniform Water Content Distributions in Unsaturated Soil Columns,
W83-00723 2G

WILHELM, G.
Creation of Wetland Habitats in Northeastern Illinois,
W83-00944 5G

WILLEY, J. D.
Natural Fluorescence as a Tracer for Distinguishing Between Piedmont and Coastal Plain River Water in the Nearshore Waters of Georgia and North Carolina,
W83-00857 2L

WILLIAMS, J. S.
Modern and Paleolimnological Evidence for Accelerated Leaching and Metal Accumulation in Soils in New England, Caused by Atmospheric Deposition,
W83-00956 5B

WILLIAMS, M. J.
Water From Power: Water Supply and Regional Growth in the Santa Clara Valley,
W83-00795 6D

WILLIAMS, T. J.
Evaluation of Factors Affecting the Membrane Filter Technique for Testing Drinking Water,
W83-01019 5A

WILLIAMS, T. L.
Water-Level Trends, Pumpage, and Chemical Quality in the Cambrian-Ordovician Aquifer in Illinois, 1971-1980,
W83-00947 6D

WILSON, A. E. D.
Desalter Systems for Man-Made Islands,
W83-00979 3A

WILSON, D.
Copper, Zinc, and Cadmium Concentrations of Resident Trout Related to Acid-Mine Wastes,
W83-00862 5B

WILSON, J. F. JR.
Measurement of Time of Travel and Dispersion in Streams by Dye Tracing,
W83-00985 5B

WINTER, S. J.
Numerical Modeling of Salt-Water Intrusion in the Northern Guam Lens,
W83-00946 4B

WINTERBOURN, M. J.
Are New Zealnd Stream Ecosystems Really Different.,
W83-00885 2J

WITTERS, R. E.
Daily Patterns of Apparent Photosynthesis and Evapotranspiration in a Developing Winter Wheat Crop,
W83-00823 2D

WOLANSKI, E.
Physical Properties of Great Barrier Reef Lagoon Waters Near Townsville. I. Effects of Burdekin River Floods,
W83-00759 2L

WOLFF, P.
Microelectronics - A Decisive Medium for the Realization of Automatic Telemetry Networks for Water Monitoring (Die Mikroelektronik - ein Entscheidendes Mittel bei der Realisierung Automatischer Fermnessnetze zue Gewasseruberwachung),
W83-00975 7A

WONG, A.
A Method for the Evaluation of Effluent Quality of Various Mechanical Pulping Processes,
W83-00750 5A

WOODLEY, W. L.
Rainfall Results of the Florida Area Cumulus Experiment, 1970-76,
W83-00962 3B

WOODWARD, J. C.
Water Quality of the Tidal Potomac River and Estuary, Hydrologic Data Report, 1980 Water Year,
W83-00984 7C

WOOLHISER, D. A.
Estimation of Multiple Inflows to a Stream Reach Using Water Chemistry Data,
W83-00722 2E

WRIGHT, E. P.
Hydrogeology of the Kufra and Sirte Basins, Eastern Libya,
W83-00725 2F

WRIGHT, R. F.
Runoff Chemistry at a Mini-Catchment Watered With 'Unpolluted Precipitation,'
W83-00754 5B

WU, I. P.
Drip Irrigation Lateral Line Network Design,
W83-00888 3F

WU, Y. C.
Role of Phosphorus in Activated Sludge,
W83-00861 5D

YIN, F.
Spectrophotometric Determination of Microgram Amounts of Chromium(VI) and Total Chromium in Waste Water,
W83-00768 5A

YOO, K. H.
Low-Level Aerial Infrared Images for Inventory of an Irrigated Area,
W83-00733 7B

YOUNG, R. A.
Soil Erosion and Runoff From Planting to Canopy Development as Influenced by Tractor Wheel-Traffic,
W83-00889 4D

Temporal Variability of Suspended Particulate Concentrations in the New York Bight,
W83-01045 2J

YOUNG, R. J. JR.
Open Ocean Disposal of Materials Dredged from a Highly Industrialized Estuary: An Evaluation of Potential Lethal Effects,
W83-01030 5E

ZANGEN, M.
Studies on Alkaline Earth Sulfites--III. Transient Solubilities and Phase Changes of Calcium Sulfite in Seawater,
W83-00712 3A

ZAUKE, G. P.
Oxygen Concentrations and Elimination of Inorganic Phosphorus and Nitrogen in an Experimental Watercourse Stocked With Emergent Macrophytes,
W83-00843 5D

ZHU, Y. R.
Spectrophotometric Determination of Microgram Amounts of Chromium(VI) and Total Chromium in Waste Water,
W83-00768 5A

ZUBER, A.
Determining the Turnover Time of Groundwater Systems With the Aid of Environmental Tracers. 1. Models and Their Applicability,
W83-00908 2F

ORGANIZATIONAL INDEX

AGRICULTURAL RESEARCH AND EDUCATION CENTER, BRADENTON, FL.
Modeling Soybean Leaf-Water Potentials Under Nonlimiting Soil Water Conditions,
W83-00824 2I

AGRICULTURAL RESEARCH AND EDUCATION CENTER, LAKE ALFRED, FL.
Evapotranspiration Studies on Rice in Relation to Water Use Efficiency,
W83-00868 3F

AGRICULTURAL RESEARCH AND EXTENSION CENTER, AMARILLO, TX.
A Device for Rapid Measurement of Rate of Flow From Gated Irrigation Pipe,
W83-00839 3F

AKADEMIYA NAUK ESTONSKOI SSR, TALLINN. TALLINSKII POLITEKHNICHESKII INST.
Cooxidation of Benzo(A)Pyrene and Phenols on Activated Sludges,
W83-00866 5D

ALBERTA UNIV., EDMONTON. DEPT. OF CHEMISTRY.
Free Nickel Ion Concentration in Sewage by an Ion Exchange Column-Equilibration Method,
W83-00842 5A

ALBERTA UNIV., EDMONTON. DEPT. OF SOIL SCIENCE.
Drainage of an Irrigated Saline Soil in Alberta,
W83-00850 4A

ARAB CENTER FOR THE STUDIES OF ARID ZONES AND DRY LANDS, DAMASCUS (SYRIA).
Hydrogeology of the Syrian Steppe and Adjoining Arid Areas,
W83-00726 2F

ARIZONA UNIV., TUCSON. DEPT. OF SOILS, WATER, AND ENGINEERING.
Design and Testing of a New Microlysimeter for Leaching Studies,
W83-00821 7B

ASIAN INST. OF TECH., BANGKOK (THAILAND). DIV. OF ENVIRONMENTAL ENGINEERING.
The Design of Looped Water Distribution Networks by Application of Linear Programming (Die Dimensionierung Von Vermaschten Wasserverteilungsnetzen Unter Anwendung Der Linearen Programmierung),
W83-00772 8B

AUSTRALIAN INST. OF MARINE SCIENCE, TOWNSVILLE.
Physical Properties of Great Barrier Reef Lagoon Waters Near Townsville. I. Effects of Burdekin River Floods,
W83-00759 2L

AVONDALE COLL., COORANBONG (AUSTRALIA). DEPT. OF SCIENCES.
Primary Production in Three Lakes of Differing Salinity in Victoria, Australia,
W83-00775 2H

BANGLADESH SPACE RESEARCH AND REMOTE SENSING ORGANIZATION, DACCA.
A Comparison Between Vertically Integrated and Multilevel Models of Tidal Dynamics in Channels,
W83-00860 2L

BARODA UNIV. (INDIA). DEPT. OF PHARMACY.
Trace Metal Content in the Lalbag Pond of Baroda City Near the Highway,
W83-00803 5B

BATH UNIV. (ENGLAND). SCHOOL OF CHEMISTRY.
The Thermal Springs of Bath,
W83-00755 2F

BEDFORD INST. OF OCEANOGRAPHY, DARTMOUTH (NOVA SCOTIA). ATLANTIC OCEANOGRAPHIC LAB.
The Structure of Three-Dimensional Tide-Generating Currents: Experimental Verification of a Theoretical Model,
W83-00817 2L

BENCKISER (JOH. A.) G.M.B.H., LUDWIGSHAFEN AM RHEIN (GERMANY, F.R.).
Examination and Evaluation of Biological Degrading of Metal Gluconate Complexes through the Zahn/Wallens Batch Method (Prufung und Bewertung der Biologischen Abbaubarkeit von me Gluconatkomplexen im Standversuch nach Zahn/Wellens),
W83-00972 5D

BIRMINGHAM UNIV. (ENGLAND). DEPT. OF GEOLOGICAL SCIENCES.
The Value of Iodide as a Parameter in the Chemical Characterisation of Groundwaters,
W83-00901 2F

BOSTON UNIV., MA. DEPT. OF GEOGRAPHY.
Streamflow Anomaly Patterns in the U.S.A. and Southern Canada--1951-1970,
W83-00902 2E

BRITISH COLUMBIA MINISTRY OF ENVIRONMENT, VICTORIA.
A Procedure to Estimate Changes in Fish Populations Caused by Changes in Stream Discharge,
W83-00705 2E

BRUNEL UNIV., UXBRIDGE (ENGLAND). SCHOOL OF CHEMISTRY.
Gas Chromatographic Analysis of Trace Hydrocarbon Pollutants in Water Samples,
W83-00800 5A

BUREAU DE RECHERCHES GEOLOGIQUES ET MINIERES, ORLEANS (FRANCE). SERVICE GEOLOGIQUE NATIONAL.
Isotopic Identification of Gases of a Deep Origin in French Thermomineral Waters,
W83-01047 2F

BUREAU OF RECLAMATION, DENVER, CO. ENGINEERING AND RESEARCH CENTER.
Hydraulic Model Study of Choke Canyon Dam Spillway and Stilling Basin,
W83-00918 8A

Frost Action in Soil Foundations and Control of Surface Structure Heaving,
W83-00919 8D

Hydraulic Model Study of Ute Dam Labyrinth Spillway,
W83-00920 8B

Heavy Metals Pollution of the Upper Arkansas River, Colorado, and its Effects on the Distribution of the Aquatic Macrofauna,
W83-00921 5C

C.I.L. INC., MISSISSAUGA (ONTARIO). CHEMICALS RESEARCH LAB.
Reduction of Toxicity and Mutagenicity of Chlorination Effluents With Sulphur Dioxide,
W83-00764 5D

CALGARY UNIV. (ALBERTA). DEPT. OF BIOLOGY.
A Device to Measure in Situ Lotic Benthic Metabolism,
W83-00773 5B

Heterotrophic Activity and Biodegradation of Labile and Refractory Compounds by Groundwater and Stream Microbial Populations,
W83-01021 2F

CALGARY UNIV. (ALBERTA). KANANASKIS CENTER FOR ENVIRONMENTAL RESEARCH.
The Importance of Groundwater in the Transportation of Allochthonous Dissolved Organic Matter to the Streams Draining a Small Mountain Basin,
W83-00710 2F

CALIFORNIA DEPT. OF FISH AND GAME, REDDING.
Copper, Zinc, and Cadmium Concentrations of Resident Trout Related to Acid-Mine Wastes,
W83-00862 5B

CALIFORNIA UNIV., BERKELEY.
Water From Power: Water Supply and Regional Growth in the Santa Clara Valley,
W83-00795 6D

CALIFORNIA UNIV., IRVINE. DIV. OF ENVIRONMENTAL ANALYSIS.
The Occurrence of Filamentous Fungi in Drinking Water Distribution Systems,
W83-00849 5F

CALIFORNIA UNIV., RIVERSIDE. DEPT. OF SOIL AND ENVIRONMENTAL SCIENCES.
Use of Deterministic and Empirical Models to Predict Potential Evapotranspiration in an Advective Environment,
W83-00825 2D

CANADA CENTER FOR INLAND WATER, BURLINGTON (ONTARIO).
Finite Element Analysis of Horizontal and Vertical Turbulent Diffusion Problems in Lakes,
W83-01040 2H

CANADIAN CENTRE FOR INLAND WATERS, BURLINGTON (ONTARIO).
The Cation Denudation Rate as a Quantitative Index of Sensitivity of Eastern Canadian Rivers to Acidic Atmospheric Precipitation,
W83-00955 5C

CANBERRA COLLEGE OF ADVANCED EDUCATION (AUSTRALIA).
Ecological Effects of Mine Effluents on the South Esk River, North-Eastern Tasmania, II. Trace Metals,
W83-00832 5B

CANTERBURY UNIV., CHRISTCHURCH (NEW ZEALAND).
Temporal and Spatial Variation of Rainfall Anomalies in Africa South of Latitude 22 Deg During the Period of Meteorological Record,
W83-00863 2B

CANTERBURY UNIV., CHRISTCHURCH (NEW ZEALAND). DEPT. OF CHEMISTRY.
A Siphon Device for Fractionation of Runoff Samples,
W83-00884 7B

CANTERBURY UNIV., CHRISTCHURCH (NEW ZEALAND). DEPT. OF ZOOLOGY.
A Study of the Benthic Communities of Twenty Lakes in the South Island, New Zealand,
W83-00737 2H

Are New Zealnd Stream Ecosystems Really Different.,
W83-00885 2J

CASE WESTERN RESERVE UNIV., CLEVELAND, OH. DEPT. OF GEOLOGICAL SCIENCES.
High Resolution Vertical Profiles of pH in Recent Sediments,
W83-00729 5B

CENTRAL ARID ZONE RESEARCH INST. JODHPUR (INDIA).
Effect of an Ephemeral Stream on the Groundwater Level and Groundwater Quality in an Arid Zone of India,
W83-00897 4B

CENTRAL INST. FOR INDUSTRIAL RESEARCH, OSLO (NORWAY).
Sodium Mobility in a Mini-Catchment Studied With Radioactive Tracers and Artificial Precipitation,
W83-00753 5B

Runoff Chemistry at a Mini-Catchment Watered With 'Unpolluted Precipitation,'
W83-00754 5B

CENTRE DE RECHERCHES EN PHYSIQUE DE 1' ENVIRONNEMENT, ISSY-LES MOULINEAUX (FRANCE).
C-Band Radar for Determining Surface Soil Moisture,
W83-00735 7B

CHAPMAN (R. H.) CO., OAKDALE, MA.
Construction, Operation and Maintenance of Gravel Wells,
W83-00966 8A

CHINA UNIV. OF SCIENCE AND TECHNOLOGY, HEFEI. DEPT. OF CHEMISTRY.
Spectrophotometric Determination of Microgram Amounts of Chromium(VI) and Total Chromium in Waste Water,
W83-00768 5A

CHINA WATER WORKS ASSOCIATION (TAIWAN).
Unified Management of Water Supply in Taiwan.
W83-01015 5F

CHRISTIANSEN (E.A.) CONSULTING LTD., SASKATOON (SASKATCHEWAN).
Howe Lake: A Hydrodynamic Blowout Structure,
W83-00847 2H

CINCINNATI UNIV., OHIO. DEPT. OF BIOLOGICAL SCIENCES.
Evidence of Microbial Succession on Decaying Leaf Litter in an Arctic Lake,
W83-00848 2H

CITY OF LONDON POLYTECHNIC (ENGLAND). DEPT. OF BIOLOGICAL SCIENCES.
Aspects of the Biology of Estuarine Fish Populations Sampled From Power Station Trash Screens,
W83-00802 5C

CLEMSON UNIV., SC. DEPT. OF AGRICULTURAL ENGINEERING.
Runoff Water Quality From Dairy Pastures in the Piedmont Region,
W83-00870 5B

CLERMONT-FERRAND UNIV.-2, AUBIERE (FRANCE).
Aircraft Measurements of Icing in Supercooled and Water Droplet Ice Crystal Clouds,
W83-00948 3B

COLD REGIONS RESEARCH AND ENGINEERING LAB., HANOVER, NH.
Formation of Ice Crystals and Dissipation of Supercooled Fog by Artificial Nucleation, and Variations of Crystal Habit at Early Growth Stages,
W83-00949 3B

COLORADO STATE UNIV., FORT COLLINS.
Unsteady Flow Studies in China,
W83-00936 8B

COLORADO STATE UNIV., FORT COLLINS. DEPT. OF FOREST AND WOOD SCIENCES.
Relating Plant Capacitance to the Water Relations of Pinus Contorta,
W83-00784 2D

COLORADO STATE UNIV., FORT COLLINS. NATURAL RESOURCE ECOLOGY LAB.
Water Loss From a Shortgrass Steppe,
W83-00855 2D

COLORADO UNIV., BOULDER. DEPT. OF ECONOMICS.
The Performance of Appropriative Water Rights Systems in the Western United States During Drought,
W83-00882 6E

COMISION FEDERAL DE ELECTRICIDAD, MEXICO CITY.
The Los Azufres, Michoacan, Mexico, Geothermal Field,
W83-00903 2F

COMMONWEALTH SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANIZATION, CANBERRA (AUSTRALIA). DIV. OF PLANT INDUSTRY.
The Meaning of Matric Potential,
W83-00964 2I

Monte Carlo Study of the Nature of the Underwater Light Field in, and the Relationships Between Optical Properties of, Turbid Yellow Waters,
W83-01011 2H

COMMONWEALTH SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANIZATION, CANBERRA CITY (AUSTRALIA). DIV. OF PLANT INDUSTRY.
Estimation of the Scattering Coefficient of Natural Waters Using Underwater Irradiance Measurements,
W83-00744 1A

COMMONWEALTH SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANIZATION, GRIFFITH (AUSTRALIA). IRRIGATION RESEARCH LAB.
Aggregates of Particulate Matter and Aufwuchs on Elodea Canadensis in Irrigation Waters, and Inactivation of Diquat,
W83-00741 4A

COMMONWEALTH SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANIZATION, SYDNEY (AUSTRALIA). DIV. OF CLOUD PHYSICS.
A Model to Derive Precipitation Patterns and Vertical Velocities in Large-Scale Rain Systems,
W83-00894 2B

An Automatic Recording Raingage Network for a Cloud-Seeding Experiment,
W83-00950 7A

CORNALL UNIV., ITHACA, NY. DEPT. OF NATURAL RESOURCES.
The St. Lawrence River in Winter: Population Structure, Biomass, and Pattern of its Primary and Secondary Food Web Components,
W83-00779 2C

CORNELL UNIV., ITHACA, NY. DIV. OF BIOLOGICAL SCIENCES.
Effects of Experimental Acidification on Macroinvertebrate Drift Diversity in a Mountain Stream,
W83-00967 5C

CORVALLIS ENVIRONMENTAL RESEARCH LAB., OR.
Use of Fish Ventilation Frequency to Estimate Chronically Safe Toxicant Concentrations,
W83-00892 5C

DELAWARE UNIV., NEWARK. DEPT. OF CIVIL ENGINEERING.
Sediment Transport on a Gentle Slope Due to Waves,
W83-00937 2J

DELTA WORKS, THE HAGUE (NETHERLANDS). HYDRAULIC DEPT.
Conditions for Gradient-Type Dispersive Transport in One-Dimensional Turbidity Averaged Transport Models,
W83-00815 2L

DEPARTMENT OF AGRICULTURE, SUMMERLAND (BRITISH COLUMBIA). RESEARCH STATION.
Unreliabilities of Pressure Plate 1500 Kilopascal Data in Predicting Soil Water Contents at Which Plants Become Wilted in Soil-Peat Mixes,
W83-00782 2G

DEPARTMENT OF ENVIRONMENT, NEW DELHI (INDIA).
Environmental Characteristics of the Mandovi-Zuari Estuarine System in Goa,
W83-00804 2L

DEPARTMENT OF FISHERIES AND OCEANS, WINNIPEG (MANITOBA). FRESHWATER INST.
Biological, Chemical and Physical Responses of Lakes to Experimental Acidification,
W83-00957 5C

DEPARTMENT OF THE ENVIRONMENT, BURLINGTON (ONTARIO).
Lake Ontario Atmospheric Deposition, 1969-1978,
W83-00954 5B

DEPARTMENT OF THE ENVIRONMENT, HALIFAX (NOVA SCOTIA).
Acidification of Nova Scotia Lakes I: Response of Diatom Assemblages in the Halifax Area,
W83-00960 5C

DHV CONSULTING ENGINEERS, AMERSFOORT (NETHERLANDS).
A Model for the Design of Drainage in Flat Agricultural Lands,
W83-00820 4A

DUKE UNIV., BEAUFORT, NC. MARINE LAB.
Sediment Nutrient Regeneration in Three North Carolina Estuaries,
W83-00811 2L

DUKE UNIV., DURHAM, NC. DEPT. OF BOTANY.
Effects of Repeated Application of Water Stress on Water Status and Growth of Wheat,
W83-00875 2I

ECOLE NATIONALE SUPERIEURE DES MINES DE PARIS, FONTAINEBLEAU (FRANCE). CENTRE D'INFORMATION GEOLOGIQUE.
In Situ Determination of the Hydrothermal Properties of a Deep Fractured Medium by a Single-Well Technique,
W83-01049 2F

EGYPTIAN RESEARCH INST., CAIRO.
Hydrogeology of the Great Nubian Sandstone Basin, Egypt,
W83-00736 2F

EIDGENOESSISCHE ANSTALT FUER WASSERVERSORGUNG, ABWASSERRENIGUNG UND GEWAESSERSCHUTZ, ZURICH (SWITZERLAND).
Concepts for the Modelling of the Phosphorus Cycle in Lakes and Reservoirs (Modellvorstellungen uber den Phosphorkreislauf in Stehenden Gewassern),
W83-00971 5C

EIDGENOESSISCHE TECHNISCHE HOCHSCHULE, ZURICH (SWITZERLAND).
Electron Flow Via Sulfate Reduction and Methanogenesis in the Anaerobic Hypolimnion of Lake Mendota,
W83-00877 2H

EIDGENOESSISCHES AMT FUER UMWELTSCHUTZ, BERN (SWITZERLAND).
The Water Supply in Switzerland, A Survey of the Structure,
W83-01016 5F

ESSEX UNIV., COLCHESTER (ENGLAND). DEPT. OF BIOLOGY.
Hydrogen as an Electron Donor for Sulfate-Reducing Bacteria in Slurries of Salt Marsh Sediment,
W83-00701 2L

Exchange of Nitrate, and the Products of Bacterial Nitrate Reduction, Between Seawater and Sediments From a U.K. Saltmarsh,
W83-00812 2L

EUREAU - UNION OF WATER-SUPPLYING ASSOCIATIONS OF MEMBER COUNTRIES OF THE EUROPEAN COMMUNITIES.
Experience With the EEC Directive 75/440 on the Quality of Surface Water for Drinking Water Procurement in the Member States (Erfahrungen Mit Der Eg-Richtlinie 75/440 Uber Die Qualitat Von Oberflachenwasser Fur Die Trink-Wassergewinnung in Den Mitgliedsstaaten),
W83-00771 6F

EXTREMADURA UNIV., BADAJOZ (SPAIN). DEPT. OF ANALYTICAL CHEMISTRY.
Spectrophotometric Determination of Sulphide in Water by Re-Extraction and Ligand Exchange Using Chloroform Solutions of Copper Quinolin-8-Olate,
W83-01036 5A

FISH AND WILDLIFE SERVICE, CLEMSON, SC. SOUTHEAST RESERVOIR INVESTIGATIONS.
Effect of Thermal Effluents on Oligochaetes in Keowee Reservoir, South Carolina,
W83-00731 5C

FLORIDA STATE DEPT. OF ENVIRONMENTAL REGULATION, TALLAHASSEE.
Long-Term Variation of Macroinvertebrate Assemblages in Apalachee Bay, Florida,
W83-00845 5C

FLORIDA UNIV., GAINESVILLE. DEPT. OF ENVIRONMENTAL ENGINEERING SCIENCE.
The Trophic Response of Ciliated Protozoans in Freshwater Lakes,
W83-00704 5C

FRESHWATER BIOLOGICAL ASSOCIATION, AMBLESIDE (ENGLAND).
Records of a Lakes' Life in Time: The Sediments,
W83-00708 5C

GEOLOGICAL SURVEY, BATON ROUGE, LA. WATER RESOURCES DIV.
Water Resources Programs of the U.S. Geological Survey Related to Agriculture in Louisiana,
W83-01007 7C

GEOLOGICAL SURVEY, BOISE, ID. WATER RESOURCES DIV.
Water Resources Data, Idaho, Water Year 1981--Volume 2. Upper Columbia River Basin and Snake River Basin Below King Hill.
W83-00993 7C

Water Resources Data, Idaho, Water Year 1981--Volume 1. Great Basin and Snake River Basin above King Hill,
W83-01003 7C

GEOLOGICAL SURVEY, BOSTON, MA. WATER RESOURCES DIV.
Hydrologic Effects of Highway-Deicing Chemicals in Massachusetts--Executive Summary,
W83-01008 4C

GEOLOGICAL SURVEY, COLUMBUS, OH. WATER RESOURCES DIV.
Water Resources Data, Ohio, Water Year 1981--Volume 1. Ohio River Basin.
W83-01000 7C

Water Resources Data, Ohio, Water Year 1981--Volume 2. St. Lawrence River Basin Statewide Project Data.
W83-01001 7C

GEOLOGICAL SURVEY, DENVER, CO. WATER RESOURCES DIV.
Sulfur Isotopic Composition and Water Chemistry in Water from the High Plains Aquifer, Oklahoma Panhandle and Southwestern Kansas,
W83-00987 2F

GEOLOGICAL SURVEY, HARRISBURG, PA. WATER RESOURCES DIV.
Water Resources Data, Pennsylvania, Water Year 1981--Volume 3. Ohio River and St. Lawrence River Basin.
W83-00997 7C

Water Resources Data, Pennsylvania, Water Year 1981--Volume 2. Susquehanna and Potomac River Basins.
W83-00998 7C

GEOLOGICAL SURVEY, HARTFORD, CT. WATER RESOURCES DIV.
A Method for Estimating the 7-Day, 10-Year Low Flow of Streams in Connecticut,
W83-00991 2E

Streamflow Information for Connecticut with Applications to Land-Use Planning,
W83-00992 3E

GEOLOGICAL SURVEY, HELENA, MT. WATER RESOURCES DIV.
Hydrology of the Prairie Dog Creek Drainage Basin, Rosebud and Big Horn Counties, Montana,
W83-00990 7C

Water Resources Data, Montana, Water Year 1981--Volume 2. Columbia River Basin.
W83-01002 7C

GEOLOGICAL SURVEY, HURON, SD. WATER RESOURCES DIV.
Water Resources Data, South Dakota, Water Year 1981.
W83-00999 7C

GEOLOGICAL SURVEY, LAKEWOOD, CO. WATER RESOURCES DIV.
Water Resources Data, Colorado, Water Year 1981--Volume 1. Missouri River Basin, Arkansas River Basin, and Rio Grande Basin.
W83-00995 7C

Water Resources Data, Colorado, Water Year 1981--Volume 2. Colorado River Basin Above Dolores River.
W83-00996 7C

U. S. Geological Survey Standard Reference Water Samples for Pesticides,
W83-01005 5G

GEOLOGICAL SURVEY, LANSING MI. WATER RESOURCES DIV.
Water Resources Data, Michigan, Water Year 1981.
W83-00994 7C

GEOLOGICAL SURVEY, LINCOLN, NE. WATER RESOURCES DIV.
Groundwater Levels in Nebraska, 1981,
W83-01004 2F

GEOLOGICAL SURVEY, MENLO PARK, CA.
Laboratory Measurements of Reservoir Rock From the Geysers Geothermal Field, California,
W83-00770 8E

GEOLOGICAL SURVEY, OKLAHOMA CITY, OK. WATER RESOURCES DIV.
Water Type and Suitability of Oklahoma Surface Waters for Public Supply and Irrigation. Part 2: Salt Fork Arkansas River and Cimarron River Basins Through 1978,
W83-00989 7C

GEOLOGICAL SURVEY, RESTON, VA. WATER RESOURCES DIV.
Water Quality of the Tidal Potomac River and Estuary, Hydrologic Data Report, 1980 Water Year,
W83-00984 7C

Measurement of Time of Travel and Dispersion in Streams by Dye Tracing,
W83-00985 5B

U.S. Geological Survey Activities, Fiscal Year 1981.
W83-01009 7C

Geological Survey Research 1981.
W83-01010 7C

GEOLOGICAL SURVEY, SACRAMENTO, CA. WATER RESOURCES DIV.
Water-Quality Assessment of the Smith River Drainage Basin, California and Oregon.
W83-01006 7C

GEOLOGICAL SURVEY, URBANA, IL. WATER RESOURCES DIV.
Time of Concentration and Storage Coefficient Values for Illinois Streams,
W83-00986 2A

A Technique for Estimating Time of Concentration and Storage Coefficient Values for Illinois Streams,
W83-00988 2A

GEORGIA INST. OF TECH., ATLANTA. CENTER FOR THE ADVANCEMENT OF COMPUTATIONAL MECHANICS.
Accuracy of Finite Element Solutions of Navier-Stokes Equations Using a Velocity-Pressure Formulation,
W83-01039 2E

GEORGIA UNIV., SAPELO ISLAND. MARINE INST.
Carbon Isotope Composition of Organic Seston and Sediments in a Georgia Salt Marsh Estuary,
W83-00787 2L

GEZIRA UNIV., WAD MEDANI (SUDAN). DEPT. OF BIOLOGICAL SCIENCES.
On the Introduction of Phytophagous Fishes into Gravity-Flow Irrigation Systems in the Sudan,
W83-00783 4A

GLASGOW UNIV. (SCOTLAND). DEPT. OF CIVIL ENGINEERING.
Rating Curves for Rivers With Overbank Flow,
W83-00751 2E

GRIFFITH UNIV., NATHAN (AUSTRALIA). SCHOOL OF AUSTRALIAN ENVIRONMENTAL STUDIES.
The Three-Parameter Infiltration Equation,
W83-00734 2G

GRONINGEN RIJKSUNIVERSITEIT (NETHERLANDS). DEPT. OF MICROBIOLOGY.
Community Metabolism of Intertidal Flats in the Ems-Dollard Estuary,
W83-00702 2L

GUAM UNIV., AGANA. WATER AND ENERGY RESEARCH INST. OF THE WESTERN PACIFIC.
Numerical Modeling of Salt-Water Intrusion in the Northern Guam Lens,
W83-00946 4B

GUNMA INST. OF PUBLIC HEALTH, MAEBASHI (JAPAN).
The Behaviour of Methylene Blue Active Substance (MBAS) in Bottom Muds Under Laboratory Conditions,
W83-00717 2K

HARBOR BRANCH FOUNDATION, INC., FORT PIERCE, FL.
Local Energy Exchanges in a Shallow, Coastal Lagoon: Winter Conditions,
W83-00858 2L

HARVARD LAW SCHOOL, CAMBRIDGE, MA.
Ocean Dumping of Sewage Sludge: The Tide Turns From Protection to Management,
W83-00732 6E

HAWAII UNIV., HONOLULU. DEPT. OF AGRICULTURAL ENGINEERING.
Drip Irrigation Lateral Line Network Design,
W83-00888 3F

HELSINKI CITY WATERWORKS (FINLAND).
Operations Monitoring System at the Helsinki City Waterworks,
W83-01032 5F

HELSINKI UNIV. OF TECHNOLOGY, OTANIEMI (FINLAND). SYSTEMS THEORY LAB.
A Lumped-Parameter Model for Infiltration,
W83-00913 2G

HOKKAIDO UNIV. (JAPAN). GRADUATE SCHOOL OF FISHERIES.
Pathway and Distribution of Trace Elements in Lake Vanda, Antarctica,
W83-00756 5B

IBADAN UNIV. (NIGERIA). DEPT. OF PREVENTIVE AND SOCIAL MEDICINE.
A Field Study of Estuarine Pollution in Madras, India,
W83-00881 5B

IBADAN UNIV. (NIGERIA). DEPT. OF ZOOLOGY.
The Physico-Chemical Hydrology of a Tropical Seasonal River-Upper Ogun River,
W83-00706 2E

IDAHO UNIV., MOSCOW. DEPT. OF AGRICULTURAL ENGINEERING.
Low-Level Aerial Infrared Images for Inventory of an Irrigated Area,
W83-00733 7B

ILLINOIS STATE WATER SURVEY DIV., CHAMPAIGN.
Water-Level Trends, Pumpage, and Chemical Quality in the Cambrian-Ordovician Aquifer in Illinois, 1971-1980,
W83-00947 6D

ILLINOIS UNIV. AT URBANA-CHAMPAIGN. DEPT. OF AGRICULTURE.
Afternoon Water Deficits and Grain Yields in Old and New Soybean Cultivars,
W83-00837 3F

ILLINOIS UNIV. AT URBANA-CHAMPAIGN. DEPT. OF HORTICULTURE.
Prediction and Control of Porosity and Water Retention in Sand-Soil Mixtures for Drained Turf Sites,
W83-00822 2G

ILLINOIS UNIV. AT URBANA-CHAMPAIGN. DEPT. OF NATURAL RESOURCE ECONOMICS.
Economics of the Water Blanket Technique for Greenhouse Heating,
W83-00762 3C

ILLINOIS UNIV. AT URBANA-CHAMPAIGN. WATER RESOURCES CENTER.
The Feasibility and Benefits of Reclaiming a Man-Made Lake: A Case Study of Lake Paradise, Mattoon, Illinois,
W83-00945 6B

INDIAN AGRICULTURAL RESEARCH INST. (NEW DELHI).
Utility of Frequency Distribution of Moisture Adequacy in the Selection of Crops for Areas With Marginal Rainfall,
W83-00806 3F

INDIAN INST. OF SCIENCE, BANGALORE. DEPT. OF CIVIL ENGINEERING.
Stochastic Modelling of Monthly Rainfall,
W83-00910 2B

INSTITUT FUER WASSERWIRTSCHAFT, BERLIN (GERMAN D.R.).
Microelectronics - A Decisive Medium for the Realization of Automatic Telemetry Networks for Water Monitoring (Die Mikroelektronik - ein Entscheidendes Mittel bei der Realisierung Automatischer Fermnessnetze zue Gewasseruberwachung),
W83-00975 7A

Determination of Geohydraulic Parameters and the Infiltration Capacity of Sand Basins for Artificial Groundwater Enrichment (Bestimmung der Geohydraulischen Parameter und der Infiltrationsleistung von Sandbecken bei Kunstlicher Grundwasseranreicherung),
W83-00983 5G

INSTITUT FUR WASSERWIRTSCHAFT, BERLIN (GERMAN, D. R.).
Computer-Supported Flood Predictions for the Improvement of flood Protection in the DDR (Rechnergestutzte Hochwasservorhersagen zue Verbesserung des Hochwasserschutzes in der DDR),
W83-00976 2E

INSTITUTE FOR ENVIRONMENTAL MANAGEMENT, WARSAW (POLAND).
Diffused Type Pollution Control for Catchment Areas of Rivers Used to Provide Drinking Water,
W83-01031 5G

INSTITUTE FOR MARINE ENVIRONMENTAL RESEARCH, PLYMOUTH (ENGLAND).
Chemical Variability in the Tamar Estuary, South-West England,
W83-00807 2L

The Dynamics of Estuarine Manganese Cycling,
W83-00809 2L

The Application of Radioisotopes in the Study of Estuarine Sedimentary Processes,
W83-00818 5B

INSTITUTE OF GEOLOGICAL SCIENCES, LONDON (ENGLAND). DEPT. OF HYDROGEOLOGY.
Hydrogeology of the Kufra and Sirte Basins, Eastern Libya,
W83-00725 2F

INSTITUTE OF GEOLOGICAL SCIENCES, OXFORDSHIRE (ENGLAND).
Laplace Transform Solutions for Solute Transport in Fissured Aquifers,
W83-01027 2F

INSTITUTE OF GEOLOGICAL SCIENCES, WALLINGFORD (ENGLAND).
A Physical Model Study of the Storage of Low-Grade Heat in Unsaturated Chalk,
W83-00904 4B

INSTITUTE OF HYDROLOGY, WALLINGFORD (ENGLAND).
Hydraulic Properties of a Major Alluval Aquifer: An Isotropic, Inhomogeneous System--Comments,
W83-00899 2F

A Flow-Proportional Sampler for Plot and Lysimeter Studies,
W83-00911 7B

INSTITUTE OF NUCLEAR PHYSICS, KRACOW (POLAND).
Determining the Turnover Time of Groundwater Systems With the Aid of Environmental Tracers. 1. Models and Their Applicability,
W83-00908 2F

INSTITUUT VOOR CULTURRTECHNIEK EN WATERHUISHOUDING, WAGENING (NETHERLANDS).
Rainfall Interstation Correlation Functions IV. On the Occurrence of Zero and Less-Than-Zero Response,
W83-00912 2B

INTERMOUNTAIN FOREST AND RANGE EXPERIMENT STATION, OGDEN, UT.
A Screen-Caged Thermcouple Psychrometer and Calibration Chamber for Measurements of Plant and Soil Water Potential,
W83-00827 7B

INTERNATIONAL ARBEITSGEMEINSCHAFT DER WASSERWERKE, RHEINEINZUGSGEBIET (GERMANY, F.R.).
The Development of the Salt Problem in the Rhine in the 60's and 70's (Die Entwicklung des Salz-Problems am Rhein in den 60er und 70er Jahren).
W83-00785 5G

INTERNATIONAL INST. FOR LAND RECLAMATION AND IMPROVEMENT, WAGENINGEN (NETHERLANDS).
A Review of Rainwater Harvesting,
W83-01025 3B

INTERNATIONAL LAB. OF MARINE RADIOACTIVITY, MONTE CARLO (MONACO). OCEANOGRAPHIC MUSEUM.
Local Variability in the Distribution of Windscale Fission Products in Estuarine Sediments,
W83-00810 5B

INTERNATIONAL RICE RESEARCH INST. MANILA (PHILIPPINES).
Design and Testing of a Microlysimeter for Wetland Rice,
W83-00826 2D

IOWA UNIV., IOWA CITY. INST. OF HYDROLOGICAL RESEARCH.
Movable-Bed Tidal Inlet Model,
W83-00941 2L

IRKUTSHII GOSUDARSTVENNYI UNIV. (USSR). SCIENTIFIC RESEARCH INST. OF BIOLOGY.
Methods of Analyzing Quinones in Water and Their Application in Studying the Effects of Hydrophytes on Phenols. Part 5: Elimination of Carcinogenic Amines From Solutions Under the Action of Nitella,
W83-00851 5D

IRKUTSKII GOSUDARSTVENNYI UNIV. (USSR). SCIENTIFIC RESEARCH INST. OF BIOLOGY.
Methods of Analyzing Quinones in Water and Their Application in Studying the Effects of Hydrophytes on Phenols. Part 3: Phenol Elimination Under the Action of Aquatic Plants,
W83-00852 5D

Methods of Analyzing Quinones in Water and Their Application in Studying the Effects of Hydrophytes on Phenols. Part 2: Polarographic Methods of Quinone Analysis,
W83-00864 5A

Methods of Analyzing Quiones in Water and Their Application in Studying the Effects of Hydrophytes on Phenols. Part 1: Quinone Determination With Benzene Sulfinic Acid,
W83-00865 5A

Transformation of Benzo(a)pyrene in a Mixture with Phenols under the Effect of Algae and Their Enzyme Preparations,
W83-00961 5B

JAGIELLONIAN UNIV., KRAKOW (POLAND). INST. OF ENVIRONMENTAL BIOLOGY.
Ecology of the Forest Stream Lane Bloto in the Niepolomice Forest 1. Chemism of Water and Bottom Sediments and its Changes Under the Influence of Industrial Pollution,
W83-00763 5B

JOHNS HOPKINS UNIV., BALTIMORE, MD. DEPT. OF GEOGRAPHY.
Forecasting Short-Term Revenues for Water and Sewer Utilities,
W83-01042 6D

KANSAS AGRICULTURAL EXPERIMENT STATION, MANHATTAN. EVAPOTRANSPIRATION LAB.
Daily Patterns of Apparent Photosynthesis and Evapotranspiration in a Developing Winter Wheat Crop,
W83-00823 2D

KEAN COLL. OF NEW JERSEY, UNION. DEPT. OF CHEMISTRY/PHYSICS.
Metal Sulfides in Estuarine Sediments,
W83-01044 5B

KENT STATE UNIV., OH. DEPT.OF GEOLOGY.
A New Geothermal Anomaly in Nicaragua,
W83-00895 2F

KENTUCKY UNIV., LEXINGTON. DEPT. OF GEOGRAPHY.
Changes in the Environmental Pollution in the Calcutta-Hooghlyside Industrial Strip of India,
W83-00801 5B

KING ALFRED'S COLL., WINCHESTER (ENGLAND).
The Politics of Water Pollution Control: A Case Study of the Canadian Fisheries Act Amendments and the Pulp and Paper Effluent Regulations, 1970,
W83-00951 6E

KOMMUNALE VEREINIGUNG FUER WASSER- UND ABFALLWIRTSCHAFT E.V., STUTTGART (GERMANY, F.R.).
Investigation into Water Exchange in Reservoirs of Different Shapes and Different Arrangement of Inlet and Discharge Pipes,
W83-01035 5G

KONGELIGE VETERINAER- OG LANDBOHOEJSKOLE, COPENHAGEN (DENMARK). JORDBRUGSTEKNISK INST.
Drought Sensitivity at Various Growth Stages of Barley in Relation to Relative Evapotranspiration and Water Stress,
W83-00838 3F

KYOTO UNIV. (JAPAN). GEOPHYSICAL RESEARCH STATION.
Vertical Distribution of 137-CS and its Accumulation Rate in Lake Sediments,
W83-00780 2J

LABORATOIRE NATIONAL D'HYDRAULIQUE, CHATOU (FRANCE).
New Method for Tidal Current Computation,
W83-00939 2L

LAMONT-DOHERTY GEOLOGICAL OBSERVATORY, PALISADES, NY.
Reconstruction of Past Ice Conditions in a Hudson Bay Estuary Using Tree Rings,
W83-00766 2C

Copepod Communities in the Estuary and Coastal Plume of the Hudson River,
W83-00813 2L

LANGSTON UNIV., OK.
The Effects of Nutrient, pH and Herbicide Levels on Algal Growth,
W83-00707 5C

LIFE SAVERS, INC., PORT CHESTER, NY.
Large Bore Coated Columns in Analysis for Trace Organic Pollutants in Water,
W83-00963 5A

LIVERPOOL UNIV. (ENGLAND). DEPT. OF ZOOLOGY.
Environmental Effects of River Channel Works Used in Land Drainage Improvement,
W83-00952 6G

LOS ALAMOS NATIONAL LAB., NM.
A Comparison Study for Determining Dissolved Boron in Natural Water and Geothermal Fluid,
W83-00761 5A

LOUISIANA STATE UNIV., BATON ROUGE. COASTAL STUDIES INST.
Physical Processes and Sedimentation on a Broad, Shallow Bank,
W83-00816 2J

LUND UNIV. (SWEDEN). LIMNOLOGICAL INST.
The Phosphorus Economy of a Hypertrophic Seepage Lake in Scania, South Sweden Groundwater Influence,
W83-00777 2H

Goals, Methods and Possibilities for Directing Development of Limnic Ecosystems,
W83-00790 5G

Structure and Productivity of Epiphytic Algal Communities on Lobelia Dortmanna L. in Acidified and Limed Lakes,
W83-00959 5G

MAINE UNIV. AT ORONO. DEPT. OF GEOLOGICAL SCIENCES.
Modern and Paleolimnological Evidence for Accelerated Leaching and Metal Accumulation in Soils in New England, Caused by Atmospheric Deposition,
W83-00956 5B

MARYLAND UNIV., COLLEGE PARK. DEPT. OF CIVIL ENGINEERING.
Activated Sludge,
W83-00943 5D

MASSEY UNIV., PALMERSTON NORTH (NEW ZEALAND).
Removal of Nitrogen and Phosphorus From Untreated Milking-Shed Wastes After Application to Permanent Pasture,
W83-00819 5E

MATERIALS RESEARCH LABS., ASCOT VALE (AUSTRALIA).
Nature and Hydrocarbon Content of Blooms of the Alga Botryococcus Braunii Occurring in Australian Freshwater Lakes,
W83-00743 2H

MCGILL UNIV., MONTREAL (QUEBEC).
The Estimation of Rain From Satellite-Borne Microwave Radiometers,
W83-00876 2B

MCGILL UNIV., MONTREAL (QUEBEC), DEPT. OF BIOLOGY.
The Relation Between Fisheries Management and Limnology,
W83-00873 5C

MEDGAR EVERS COLL., BROOKLYN.
Interactions Between Suspended Organic Matter and Copepod Grazing in the Plume of the Hudson River,
W83-00793 2L

MICHIGAN DEPT. OF PUBLIC HEALTH, LANSING. BUREAU OF DISEASE CONTROL AND LAB. SERVICES.
Evaluation of Factors Affecting the Membrane Filter Technique for Testing Drinking Water,
W83-01019 5A

MICHIGAN UNIV., ANN ARBOR. DEPT. OF GEOLOGICAL SCIENCES.
Sedimentology of Muddy Fine-Grained Channel Deposits in Meandering Streams of the American Middle West,
W83-00933 2J

MICHIGAN UNIV., ANN ARBOR. SCHOOL OF NATURAL RESOURCES.
Use of Conventional Fishery Models to Assess Entrainment and Impingement of Three Lake Michigan Fish Species,
W83-00891 8I

MIDDLE EAST TECHNICAL UNIV., ANKARA (TURKEY). DEPT. OF MARINE SCIENCES.
Ebb-Tidal Flow Characteristics Near Inlets,
W83-00859 2L

MINEREX LTD., DUBLIN (IRELAND).
Hydrogeological Conditions in the Middle East,
W83-00724 2F

MINISTRY OF AGRICULTURE AND WATER, RIYADH (SAUDI ARABIA).
Hydrogeology of the Umm Er Radhuma Aquifer, Saudi Arabia, With Reference to Fossil Gradients,
W83-00727 2F

MINISTRY OF WORKS AND DEVELOPMENT, PALMERSTON NORTH (NEW ZEALAND).
Raingauge Network Reduction,
W83-00900 7A

MINNESOTA UNIV., DULUTH. DEPT. OF GEOLOGY.
Total Organic Carbon in Lake Superior Sediments: Comparisons With Hemipelagic and Pelagic Marine Environments,
W83-00878 2H

MISSOURI DEPT. OF CONSERVATION, COLUMBIA.
Socioeconomic Value of the Trout Fishery in Lake Taneycomo, Missouri,
W83-00872 6C

MISSOURI PUBLIC SERVICE COMMISSION, ST. LOUIS.
Reducing the Cost of Water Pollution Control Under the Clean Water Act,
W83-00757 6E

MISSOURI UNIV., COLUMBIA. DEPT OF AGRICULTURAL ENGINEERING.
Time of Concentration Determination for Small Watersheds,
W83-00871 2A

MISSOURI UNIV. - COLUMBIA. SCHOOL OF FORESTRY, FISHERIES AND WILDLIFE.
Biotic Index Tested for Ability to Assess Water Quality of Missouri Ozark Streams,
W83-00728 5A

MOBIL OIL CANADA. LTD., CALGARY (ALBERTA).
Effects of Stream-Crossing by a Pipeline on the Benthic Macroinvertebrate Communities of a Small Mountain Stream,
W83-00789 5C

MONASH UNIV., CLAYTON (AUSTRALIA). DEPT. OF ZOOLOGY.
Invertebrate Fauna and Ecology of Temporary Pools on Granite Outcrops in Southern Western Australia,
W83-00740 2H

MONTPELLIER-2 UNIV. (FRANCE). LAB. D'HYDROLOGIE MATHEMATIQUE.
Dispersive Transfer and Pesticide Propagation in a Submerged Rice-Field (Transferts Dispersifs et Propagation de Pesticides Dans un Sol de Riziere Inondee),
W83-00907 5B

MOTOR-COLUMBUS INGENIEURUNTERNEHMUNG A.G., (SWITZERLAND).
Control of Pore Water Pressures at the Zervreila Arch Dam (Messen von Porenwasserdruck im Untergrund der Bogenstaumauer Zervreila),
W83-00973 8D

NABISCO WASTEWATER TREATMENT CENTER, MARSEILLES, IL.
Combined Treatment Plant Handles City and Paperboard Mill Effluent,
W83-00893 5D

NAGOYA UNIV. (JAPAN). WATER RESEARCH INST.
Diurnal Change of 14C-Glucose Uptake by Epilimnetic Microbes in Lake Kizaki,
W83-00715 2H

Vertical Distribution of Free-Living and Attached Heterotrophic Bacteria in Lake Kizaki,
W83-00718 2H

Studies on the Decompositive Processes of Phytoplanktonic Organic Matter,
W83-00720 2H

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION, GREENBELT, MD. LAB. FOR ATMOSPHERIC SCIENCES.
Calculations on a Model for the Future Behaviour of Griesgletscher, Wallis (Modellrechnungen zum Zukunftigen Verhalten des Griesgletschers, Wallis),
W83-00982 2C

NATIONAL BOARD OF WATERS, HELSINKI (FINLAND).
Changes in Quality of Finnish Inland Waters Revealed by Grouping Analysis,
W83-00791 2H

NATIONAL HURRICANE AND EXPERIMENTAL METEOROLOGY LAB., CORAL GABLES, FL.
Rainfall Results of the Florida Area Cumulus Experiment, 1970-76,
W83-00962 3B

NATIONAL HYDROLOGY RESEARCH INST., OTTAWA (ONTARIO).
Measurement of Snow Water Storage in the Lake Superior Basin Using Aerial Gamma-Ray Spectrometry,
W83-00965 7B

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, MIAMI, FL. ATLANTIC OCEANOGRAPHIC AND METEOROLOGICAL LAB.
Temporal Variability of Suspended Particulate Concentrations in the New York Bight,
W83-01045 2J

NATIONAL PHYSICAL RESEARCH LAB., PRETORIA (SOUTH AFRICA).
Studies on Alkaline Earth Sulfites--III. Transient Solubilities and Phase Changes of Calcium Sulfite in Seawater,
W83-00712 3A

NAVAL OCEANS SYSTEMS CENTER, SAN DIEGO, CA.
Seabed Drifter Movement in San Diego Bay and Adjacent Waters,
W83-00738 2L

NAVAL RESEARCH LABORATORY, WASHINGTON, DC.
Trace Metal Partitioning in the Aqueous Surface Microlayer of a Salt Marsh,
W83-00814 5B

NEW MEXICO INST. OF MINING AND TECHNOLOGY, SOCORRO. DEPT. OF GEOSCIENCE.
Free Surface and Saturated-Unsaturated Analyses of Borehole Infiltration Tests Above the Water Table,
W83-01038 2G

NEW MEXICO STATE UNIV., LAS CRUCES.
Energy Market Impacts of the Legal Definition of Geothermal Energy in the Western United States,
W83-00883 6E

NEW MEXICO STATE UNIV., LAS CRUCES. DEPT. OF AGRICULTURAL ENGINEERING.
Yield of Alfalfa and Cotton as Influenced by Irrigation,
W83-00836 3F

Comparison of Sprinkler, Trickle, Subsurface, and Furrow Irrigation Methods for Row Crops,
W83-00840 3F

NEW MEXICO STATE UNIV., LAS CRUCES. DEPT. OF AGRONOMY.
A Rapid Technique for Obtaining Uniform Water Content Distributions in Unsaturated Soil Columns,
W83-00723 2G

NEW MEXICO STATE UNIV., LAS CRUCES. DEPT. OF EARTH SCIENCES.
Composition of Modern Stream Sand in a Humid Climate Derived From a Low-Grade Metamorphic and Sedimentary Foreland Fold-Thrust Belt of North Georgia,
W83-00931 2J

NEW YORK STATE MUSEUM, ALBANY.
Effect of Light Intensity of Sulfate Uptake and Primary Productivity by Natural Freshwater Microplankton Communities and Axenic Algal Cultures,
W83-00778 2H

Limnology of a Eutrophic Reservoir: Big Bear Lake, California,
W83-00846 5C

NIHON UNIV., TOKYO (JAPAN). DEPT. OF FISHERIES.
Bacterial Flora of the Water and Sediment in the Edo River Mouth (In Japanese),
W83-00781 5C

NORDRHEIN-WESTFALEN LANDESAMT FUER WASSER UND ABFALL, DUSSELDORF (GERMANY, F.R.).
Limnology of Shallow Lakes and Reservoirs (Limnologie Flacher Seen und Talsperren),
W83-00981 2H

NORTH CAROLINA DIV. OF ENVIRONMENTAL MANAGEMENT, RALEIGH.
Variable Effects of Sediment Addition on Stream Benthos,
W83-00730 4C

NORTH CAROLINA UNIV. AT WILMINGTON. DEPT. OF CHEMISTRY.
Natural Fluorescence as a Tracer for Distinguishing Between Piedmont and Coastal Plain River Water in the Nearshore Waters of Georgia and North Carolina,
W83-00857 2L

NORTH-EASTERN HILL UNIV., SHILLONG (INDIA). DEPT. OF BOTANY.
Algal Dynamics in Relation to Physico-Chemical Factors in a High Altitude Pond of Shillong, India,
W83-00853 2H

NORTH-EASTERN HILL UNIV., SHILLONG (INDIA). DEPT. OF ZOOLOGY.
Primary Productivity in Relation to the Abiotic Factors in a Temporary Freshwater Pond,
W83-00854 2H

NORTHERN TECHNICAL SERVIES, HOUSTON, TX.
Hydraulic Properties of a Major Alluvial Aquifer: An Isotropic, Inhomogeneous System--Reply,
W83-00898 2F

NORWEGIAN HYDRODYNAMIC LAB., TRONDHEIM. DIV. RIVER AND HARBOUR LAB.
On the Heat Exchange Between Rivers and Atmosphere,
W83-00752 2A

NOTTINGHAM UNIV. (ENGLAND). DEPT. OF PHYSIOLOGY AND ENVIRONMENTAL STUDIES.
Crop Evaporation, Surface Resistance and Soil Water Status,
W83-00856 2I

OAK RIDGE NATIONAL LAB., TN.
Water Decontamination Process Improvement Tests and Considerations,
W83-01037 5D

OAK RIDGE NATIONAL LAB., TN. ENVIRONMENTAL SCIENCES DIV.
Formation of Freshwater Fe-Mn Coatings on Gravel and the Behavior of Co60, Sr90, and Cs137 in a Small Watershed,
W83-00788 5B

OLD DOMINION UNIV., NORFOLK, VA. DEPT. OF BIOLOGICAL SCIENCES.
Open Ocean Disposal of Materials Dredged from a Highly Industrialized Estuary: An Evaluation of Potential Lethal Effects,
W83-01030 5E

OLDENBURG UNIV. (GERMANY, F.R.).
Application of Multiple Discriminant Analysis on the Analysis of the Correlation Between Macrophyte Vegetation and Water Quality in Running Waters of Central Europe,
W83-00776 5A

OLDENBURG UNIV. (GERMANY, F.R.) DEPT. OF BIOLOGY.
Oxygen Concentrations and Elimination of Inorganic Phosphorus and Nitrogen in an Experimental Watercourse Stocked With Emergent Macrophytes,
W83-00843 5D

ONTARIO MINISTRY OF THE ENVIRONMENT, REXDALE.
The Use of Calibrated Lakes and Watersheds for Estimating Atmospheric Deposition Near a Large Point Source,
W83-00953 5B

ORAN UNIV. (ALGERIA). DEPT. OF GEOLOGY.
Algerian Thermalism in its Geostructural Setting--How Hydrogeology has Helped in the Elucidation of Algeria's Deep-Seated Structure,
W83-00896 2F

ORANGE FREE STATE UNIV., BLOEMFONTEIN (SOUTH AFRICA).
Galerkin Finite Element Method and the Groundwater Flow Equation: 1. Convergence of the Method,
W83-01041 2F

OREGON STATE UNIV., CORVALLIS. DEPT. OF MICROBIOLOGY.
Selection of Antibiotic-Resistant Standard Plate Count Bacteria During Water Treatment,
W83-01020 5F

OREGON STATE UNIV., CORVALLIS. SCHOOL OCEANOGRAPHY.
The Applicability of the Gibbs Euation for Grain Settling Velocities to Conditions Other Than Quartz Grains in Water,
W83-00930 2J

OSAKA UNIV. (JAPAN). DEPT. OF APPLIED CHEMISTRY.
Determination of Sulphide Ion at Trace Levels by Ethylation and Gas Chromatography,
W83-00805 5A

OSAKA UNIV. (JAPAN). DEPT. OF ENVIRONMENTAL ENGINEERING.
Stabilization of Waste-Activated Sludge Through the Anoxic-Aerobic Digestion Process,
W83-00713 5E

PAPRICAN, POINT-CLAIRE (QUEBEC).
A Method for the Evaluation of Effluent Quality of Various Mechanical Pulping Processes,
W83-00750 5A

PARIS UNIV., THONON-LES-BAINS (FRANCE). CENTER FOR GEODYNAMIC RESEARCH.
Information About the Origin of Thermomineral Waters and Gas by Means of Environmental Isotopes in Eastern Azerbaijan, Iran, and Southeast France,
W83-01050 2K

PARMA UNIV. (ITALY). LAB. DI ECOLOGIA.
Ciliated Protozoa and Water Quality in the Torrente Stirone (Northern Italy),
W83-00749 5C

PERADENIYA UNIV., SRI LANKA. DEPT. OF GEOLOGY.
The Significance of Natural Environmental Factors in the Distribution of Copper in Potable Waters of Sri-Lanka,
W83-00798 5B

PITTSBURGH UNIV., PA. DEPT. OF CIVIL ENGINEERING.
Role of Phosphorus in Activated Sludge,
W83-00861 5D

PLYMOUTH POLYTECHNIC (ENGLAND). DEPT. OF ENVIRONMENTAL SCIENCES.
Aquatic Distribution and Heterotrophic Degradation of Polycyclic Aromatic Hydrocarbons (PAH) in the Tamar Estuary,
W83-00808 5B

PROCTER AND GAMBLE CO., CINCINNATI, OH.
Determination of Trace Levels of Quaternary Ammonium Compounds in River Water by Liquid Chromatography With Conductometric Detection,
W83-00841 5A

PURDUE UNIV., LAFAYETTE, IN. DEPT. OF AGRICULTURAL ENGINEERING.
Finite Element Model to Describe Overland Flow on an Infiltrating Watershed,
W83-00867 2E

A Monitoring/Modeling Strategy for 208 Implementation,
W83-00890 5B

RAJA BALWANT SINGH COLL., AGRA (INDIA). DEPT. OF AGRICULTURAL CHEMISTRY.
Quality of Underground Irrigation Waters in Semi-Arid Tract of District Agra. III. Tehsils Bay and Fatehabad,
W83-01023 2K

RESEARCH INST. FOR WATER RESOURCES DEVELOPMENT, BUDAPEST (HUNGARY).
A Layered Thermal-Water Twin Flow System,
W83-00906 2F

An Approach to the Study of Transverse Mixing in Streams,
W83-00909 2E

RESOURCE ASSOCIATES, CHICAGO, IL.
Creation of Wetland Habitats in Northeastern Illinois,
W83-00944 5G

RIO GRANDE UNIV. (BRAZIL). LAB. DE BOTANICA MARINHA.
Estuarine Metal Monitoring in Southern Brazil,
W83-00880 5B

ROCKY MOUNTAIN FOREST AND RANGE EXPERIMENT STATION, ALBUQUERQUE, NM.
Seasonal Patterns of Soil Water Recharge and Extraction on Semidesert Ranges,
W83-00932 2G

ROORKEE UNIV. (INDIA). SCHOOL OF HYDROLOGY.
A Nonlinear Optimisation Method for Aquifer Parameter Estimation.
W83-00905 2F

ROSENTIEL SCHOOL OF MARINE AND ATMOSPHERIC SCIENCE, MIAMI, FL.
Columbia River Entrance Channel Ship Motion Study,
W83-00935 8B

ROYAL AUSTRALIAN AIR FORCE ACADEMY, POINT COOK (AUSTRALIA). DEPT. OF CHEMISTRY.
Equilibrium Status of Some Mineral Springs in Victoria,
W83-00760 2K

ROYAL TROPICAL INST., AMSTERDAM (NETHERLANDS). DEPT. OF AGRICULTURAL RESEARCH.
Synergistic Effect of Gibberellic Acid and Chlorflurenol on 2,4-D With Regard to Water Hyacinth,
W83-00745 4A

SAINT DAVID'S UNIV. COLL., LAMPETER (WALES). DEPT. OF GEOGRAPHY.
Water Temperature Variability as an Indicator of Shallow-Depth Groundwater Behaviour in Limestone Areas in West Malaysia,
W83-01048 2F

SCIENCE AND EDUCATION ADMINISTRAITION, TIFTON, GA. SOUTHEAST WATERSHED RESEARCH LAB.
Sediment-Delivery Ratios for a Small Coastal Plain Agricultural Watershed,
W83-00869 2J

SCIENCE AND EDUCATION ADMINISTRATION, MORRIS, MN.
Soil Erosion and Runoff From Planting to Canopy Development as Influenced by Tractor Wheel-Traffic,
W83-00889 4D

SCIENCE AND EDUCATION ADMINISTRATION, PHOENIX, AZ. WATER CONSERVATION LAB.
Evaluating Infiltration for Border Irrigation Models,
W83-01026 3F

SCIENCE AND EDUCATION ADMINISTRATION, ST. PAUL, MN.
Maize Culture in Reed Canarygrass Sod to Renovate Municipal Wastewater Effluent,
W83-01024 3C

SCIENCE AND EDUCATION ADMINISTRATION, TEMPLE, TX. GRASSLAND, SOIL AND WATER RESEARCH LAB.
Water Deficit Effects on Water Potential, and Water Use of Cowpeas,
W83-00835 2I

SCIENCE AND EDUCATION ADMINISTRATION, TUCSON, AZ. SOUTHWEST RANGELAND WATERSHED RESEARCH CENTER.
Estimation of Multiple Inflows to a Stream Reach Using Water Chemistry Data,
W83-00722 2E

SHEFFIELD UNIV. (ENGLAND). DEPT. OF BOTANY.
Status of Aquatic Macrophytes in an Undrained Area of Fen in the Norfolk Broads, England,
W83-00746 5C

SHEFFIELD UNIV. (ENGLAND). DEPT. OF CIVIL STRUCTURAL ENGINEERING.
Cyclical Relationships Between River Discharge and Chemical Concentration During Flood Events,
W83-01046 2E

SIMON FRASER UNIV., BURNABY (BRITISH COLUMBIA). DEPT. OF BIOLOGICAL SCIENCES.
Attached and Free-Floating Bacteria in the Fraser River Estuary, British Columbia, Canada,
W83-00879 2L

SOIL AND IRRIGATION RESEARCH INST. PRETORIA (SOUTH AFRICA).
Water Use by Wheat and Plant Indicators of Available Soil Water,
W83-00828 2I

SONAT OFFSHORE DRILLING, INC., HOUSTON, TX.
Nonlinear Diffraction by Eigenfunction Expansions,
W83-00942 8B

SOUTHERN FOREST EXPERIMENT STATION, PINEVILLE, LA.
Predicting Height and Relative Performance of Major Southern Pines From Rainfall, Slope, and Available Soil Moisture,
W83-00769 2I

SOUTHWESTERN UNIV. SCHOOL OF LAW, LOS ANGELES, CA.
The Availability of Private Remedies for Acid Rain Damage,
W83-00794 6E

STATE UNIV. OF NEW YORK AT BINGHAMTON. DEPT. OF GEOLOGICAL SCIENCES.
Hydraulic Interpretation of Grain-Size Distributions Using A Physical Model for Bedload Transport,
W83-00929 2J

STUTTGART UNIV. (GERMANY, F. R.). INST. FUE WASSERBAU.
Design and Construction of Flexible Groynes (Entwurf und bau Flexibler Buhnen),
W83-00974 8B

SULAIMANIYAH UNIV. (IRAQ). DEPT. OF BIOLOGY.
Phytoplankton Ecology of the Lake of Menteith, Scotland,
W83-00711 2H

SWEDISH WATER AND AIR POLLUTION RESEARCH LAB., GOETEBORG.
Liming of Acidified Lakes: Induced Long-Term Changes,
W83-00958 5G

TASAKI COLL. OF ECONOMICS, GUMMA (JAPAN).
Distribution of Heavy Metals in Bottom Mud of Rivers VIII. Distribution of Total and Extractable Cd and Zn,
W83-00719 5B

TASMANIA UNIV., HOBART (AUSTRALIA). DEPT. OF BOTANY.
Limnology of Perched Lake, South-West Tasmania,
W83-00742 2H

TECHNICAL UNIV. OF DENMARK, LYNGBY.
Design of Combined Nitrification-Dentrification Plants (Bemessung von Kombinierten Nitrifikations-und Denitrifikationsanlagen),
W83-00786 5D

TENNESSEE UNIV., KNOXVILLE. DEPT. OF AGRICULTURAL ECONOMICS AND RURAL SOCIOLOGY.
Distributional Constraints on Acceptance of Nonpoint Pollution Controls,
W83-00829 6C

TENNESSEE UNIV., MARTIN. DEPT. OF BIOLOGICAL SCIENCES.
Seasonal Selection in a Freshwater Heterotrophic Bacterial Community,
W83-00758 2H

TETRA TECH, INC., JACKSONVILLE, FL.
Hydromechanics of Tidal Jets,
W83-00938 2L

TEXAS A AND M UNIV., COLLEGE STATION. DEPT. OF AGRICULTURAL ECONOMICS.
Agricultural Runoff as a Nonpoint Externality: A Theoretical Development,
W83-00747 5B

TEXAS A AND M UNIV., COLLEGE STATION. DEPT. OF AGRICULTURAL ENGINEERING.
Incorporating Crop Needs Into Drainage System Design,
W83-00886 3F

TEXAS ADIVISORY COMMISSION ON INTERGOVERNMENTAL RELATIONS, AUSTIN.
Mitigating Drought Through Weather Modification: Selected Institutional and Meteorological Issues in Texas; Volume Three, Precipitation Climatology for the Edwards Plateau Region of Texas,
W83-00916 3B

TEXAS ADVISORY COMMISSION ON INTERGOVERNMENTAL RELATIONS, AUSTIN.
Mitigating Drought Through Weather Modification: Selected Institutional and Meteorological Issues in Texas; Volume One, Texas Advisory Commission on Intergovernmental Relations,
W83-00914 3B

Mitigating Drought through Weather Modification: Selected Institutional and Meteorological Issues in Texas; Volume Two, Radar Echo Characteristics in the Edwards Plateau - Balcones Escarpment Area of Texas,
W83-00915 3B

Mitigating Drought Through Weather Modification: Selected Institutional and Meteorological Issues in Texas; Volume Four, an Objective Study of the Upper-Air Conditions Relating to Precipitation Over the Southeastern Section of the Edwards Plateau in Texas,
W83-00917 3B

TOHOKU UNIV. SENDAI (JAPAN). GEOPHYSICAL INST.
Salinity Levels and Water Exchange in Gamo Lagoon,
W83-00716 2L

TOKYO METROPOLITAN UNIV. (JAPAN). DEPT. OF CHEMISTRY.
The Distribution of Urea in Lake Yunoko,
W83-00721 5B

TORONTO UNIVERSITY, SCARBOROUGH COLL., TORONTO (ONTARIO).
Limnology of Heart Lake, Ontario,
W83-00774 2H

TSUKUBA UNIV., IBARAKI (JAPAN). INST. OF BIOLOGICAL SCIENCES.
In Situ Growth and Photosynthetic Characteristics of Oscillatoria Mougeotii in the Metalimnetic Layer of the Small Eutrophic Lake Nakanuma,
W83-00714 2H

TUDOR ENGINEERING CO., DENVER, CO.
Report on Assessment of Low-Head Hydroelectric Sites in the Western States; Methology and Summary.
W83-00922 6C

Appendix to Report on Assessment of Low-Head Hydroelectric Sites in the Western States; Evaluation Reports for Low-Head Hydroelectric Sites, Part I - California.
W83-00923 8A

Appendix to Report on Assessment of Low-Head Hydroelectric Sites in the Western State; Evaluation Reports for Low-Head Hydroelectric Sites, Part II - Colorado.
W83-00924 8A

Appendix to Report on Assessment of Low-Head Hydroelectric Sites in the Western States; Evaluation Reports for Low-Head Hydroelectric Sites, Part III - Idaho and Utah.
W83-00925 8A

Appendix to Report of Assessment of Low-Head Hydroelectric Sites in the Western States; Evaluation Reports for Low-Head Hydroelectric Sites, Part IV - Kansas, New Mexico, Oklahoma, and Texas.
W83-00926 8A

Appendix to Report on Assessment of Low-Head Hydroelectric Sites in the Western States; Evaluation Reports for Low-Head Hydroelectric Sites, Part V - Montana and Wyoming.
W83-00927 8A

Appendix to Report on Assessment of Low-Head Hydroelectric Sites in the Western States; Evaluation Reports for Low-Head Hydroelectric Sites, Part VI - Oregon and Washington.
W83-00928 8A

TVARMINNE ZOOLOGICAL STATION, (FINLAND).
Dynamics of Phytoplankton in the Brackish Water Inlet Pojoviken, Southern Coast of Finland,
W83-00709 2L

UNIVERSITE DE BRETAGNE OCCIDENTALE, BREST (FRANCE). LAB. D'OCEANOGRAPHIC BIOLOGIQUE.
Physical Characteristics of an Inshore Area on the Atlantic Coast of Brittany and Their Influence on the Pelagic Ecosystem: The Case of the 'Riviere D'Etel',
W83-00792 2L

UNIVERSITY OF AGRICULTURAL SCIENCES, DHARWAD (INDIA).
Water Deficiency in Dharwad District,
W83-01022 2B

UNIVERSITY OF STRATHCLYDE, GLASGOW (SCOTLAND).
Chute Spillway Design Calculations,
W83-00765 8A

UOP INC., ST. PAUL, MN. JOHNSON DIV.
Irrigation Scheduling Using Crop Canopy-Air Temperature Difference,
W83-00887 3F

UTAH STATE UNIV., LOGAN. COLL. OF NATURAL RESOURCES.
Impact of Incremental Surface Soil Depths on Infiltrations Rates, Potential Sediment Losses, and Chemical Water Quality,
W83-00934 2J

VEB KOMBINAT WASSERTECHNIK, BERLIN (GERMAN, D.R.).
Standarization of Equipment and Facilities-An Important Prerequisite for Effective Production of Water-Related Equipment in Comecon Member Countries (Typisierung Von Ausrustugen und Anlagen - Wichtige Voraussetzung fur Eine Effektive Production Wasserwirtschaftlicher Ausrustungen in Den RGW-Mitgliedslandern,
W83-00978 5F

VICTORIA MINISTRY FOR CONSERVATION, QUEENSCLIFF (AUSTRALIA). MARINE SCIENCE LABS.
Shallow Dredging as a Strategy for the Control of Sublittoral Macrophytes: A Case Study in Tuggerah Lakes, New South Wales,
W83-00831 5G

VIRGINIA POLYTECHNIC INST. AND STATE UNIV., BLACKSBURG. DEPT. OF BIOLOGY.
Nutrient Retention and Macroinvertebrate Community Structure in a Small Stream Receiving Sewage Effluent,
W83-00844 5C

WARSAW AGRICULTURE ACADEMY (POLAND). INST. OF AGRICULTURAL FOUNDATIONS OF LAND IMPROVEMENT.
Influence of Irrigation of the Development and Yield of Potatoes,
W83-00833 3F

WASHINGTON STATE UNIV., PULLMAN. DEPT. OF CIVIL AND ENVIRONMENTAL ENGINEERING.
Titanium and Tungsten in Highway Runoff at Pullman, Washington,
W83-00799 5B

WASHINGTON UNIV., SEATTLE. DEPT. OF ZOOLOGY.
Daphnia in Lake Washington,
W83-00703 2H

WASSERWIRTSCHAFTSDIREKTION, CCOTTHUS (GERMAN, D.R.).
Expanded Criteria for the Assessment of Water Quality in running Waters (Erweiterte Kriterien zue Beurteilung der Wasserbeschaffenheit in Fliessgewassern),
W83-00977 6F

WATERLOO UNIV. (ONTARIO). DEPT. OF EARTH SCIENCES.
Seawater Intrusion in Continuous Coastal Aquifer-Aquitard Systems,
W83-01028 2F

WATERLOO UNIV. (ONTARIO). DEPT. OF GEOGRAPHY.
The Significance of Surface Temperature Patterns on the Energy Balance of a Small Lake in the Canadian Shield,
W83-01029 2H

WATERWAYS EXPERIMENT STATION, VICKSBURG, MS.
Influence of Potassium Source (Sediment Vs. Open Water) and Sediment Composition on the Growth and Nutrition of a Submersed Freshwater Macrophyte (Hydrilla Verticillata (L.F.)
W83-00830 2I

WESTERN AUSTRALIA UNIV., NEDLANDS. DEPT. OF AGRONOMY.
The Uptake of Phosphate by Carex Species for Oligotrophic to Eutrophic Swamp Habitats,
W83-00874 5B

WESTERN AUSTRALIA UNIV., NEDLANDS. DEPT. OF BOTANY.
Nutrients and Phytoplankton in Three Shallow, Fresh-water Lakes of Different Trophic Status in Western Australia,
W83-00739 5C

ZURICH WATER SUPPLY (SWITZERLAND).
Groundwater Management with Process Computers in the Hardhof Groundwater Plant of Zurich Water Supply,
W83-01014 4B

ACCESSION NUMBER INDEX

W83-00701 2L
W83-00702 2L
W83-00703 2H
W83-00704 5C
W83-00705 2E
W83-00706 2E
W83-00707 5C
W83-00708 5C
W83-00709 2L
W83-00710 2F
W83-00711 2H
W83-00712 3A
W83-00713 5E
W83-00714 2H
W83-00715 2H
W83-00716 2L
W83-00717 2K
W83-00718 2H
W83-00719 5B
W83-00720 2H
W83-00721 5B
W83-00722 2E
W83-00723 2G
W83-00724 2F
W83-00725 2F
W83-00726 2F
W83-00727 2F
W83-00728 5A
W83-00729 5B
W83-00730 4C
W83-00731 5C
W83-00732 6E
W83-00733 7B
W83-00734 2G
W83-00735 7B
W83-00736 2F
W83-00737 2H
W83-00738 2L
W83-00739 5C
W83-00740 2H
W83-00741 4A
W83-00742 2H
W83-00743 2H
W83-00744 1A
W83-00745 4A
W83-00746 5C
W83-00747 5B
W83-00748 4A
W83-00749 5C
W83-00750 5A
W83-00751 2E
W83-00752 2A
W83-00753 5B
W83-00754 5B
W83-00755 2F
W83-00756 5B
W83-00757 6E
W83-00758 2H
W83-00759 2L
W83-00760 2K
W83-00761 5A
W83-00762 3C
W83-00763 5B
W83-00764 5D
W83-00765 8A
W83-00766 2C
W83-00767 6E
W83-00768 5A
W83-00769 2I
W83-00770 8E
W83-00771 6F
W83-00772 8B
W83-00773 5B
W83-00774 2H
W83-00775 2H
W83-00776 5A
W83-00777 2H
W83-00778 2H
W83-00779 2C
W83-00780 2J
W83-00781 5C
W83-00782 2G
W83-00783 4A
W83-00784 2D
W83-00785 5G
W83-00786 5D
W83-00787 2L
W83-00788 5B
W83-00789 5C
W83-00790 5G
W83-00791 2H
W83-00792 2L
W83-00793 2L
W83-00794 6E
W83-00795 6D
W83-00796 6D
W83-00797 5G
W83-00798 5B
W83-00799 5B
W83-00800 5A
W83-00801 5B
W83-00802 5C
W83-00803 5B
W83-00804 2L
W83-00805 5A
W83-00806 3F
W83-00807 2L
W83-00808 5B
W83-00809 2L
W83-00810 5B
W83-00811 2L
W83-00812 2L
W83-00813 2L
W83-00814 5B
W83-00815 2L
W83-00816 2J
W83-00817 2L
W83-00818 5B
W83-00819 5E
W83-00820 4A
W83-00821 7B
W83-00822 2G
W83-00823 2D
W83-00824 2I
W83-00825 2D
W83-00826 2D
W83-00827 7B
W83-00828 2I
W83-00829 6C
W83-00830 2I
W83-00831 5G
W83-00832 5B
W83-00833 3F
W83-00834 3F
W83-00835 2I
W83-00836 3F
W83-00837 3F
W83-00838 3F
W83-00839 3F
W83-00840 3F
W83-00841 5A
W83-00842 5A
W83-00843 5D
W83-00844 5C
W83-00845 5C
W83-00846 5C
W83-00847 2H
W83-00848 2H
W83-00849 5F
W83-00850 4A
W83-00851 5D
W83-00852 5D
W83-00853 2H
W83-00854 2H
W83-00855 2D
W83-00856 2I
W83-00857 2L
W83-00858 2L
W83-00859 2L
W83-00860 2L
W83-00861 5D
W83-00862 5B
W83-00863 2B
W83-00864 5A
W83-00865 5A
W83-00866 5D
W83-00867 2E
W83-00868 3F
W83-00869 2J
W83-00870 5B
W83-00871 2A
W83-00872 6C
W83-00873 5C
W83-00874 5B
W83-00875 2I
W83-00876 2B
W83-00877 2H
W83-00878 2H
W83-00879 2L
W83-00880 5B
W83-00881 5B
W83-00882 6E
W83-00883 6E
W83-00884 7B
W83-00885 2J
W83-00886 3F
W83-00887 3F
W83-00888 3F
W83-00889 4D
W83-00890 5B
W83-00891 8I
W83-00892 5C
W83-00893 5D
W83-00894 2B
W83-00895 2F
W83-00896 2F
W83-00897 4B
W83-00898 2F
W83-00899 2F
W83-00900 7A
W83-00901 2F
W83-00902 2E
W83-00903 2F
W83-00904 4B
W83-00905 2F
W83-00906 2F
W83-00907 5B
W83-00908 2F
W83-00909 2E
W83-00910 2B
W83-00911 7B
W83-00912 2B
W83-00913 2G
W83-00914 3B
W83-00915 3B
W83-00916 3B
W83-00917 3B
W83-00918 8A
W83-00919 8D
W83-00920 8B
W83-00921 5C
W83-00922 6C
W83-00923 8A
W83-00924 8A
W83-00925 8A
W83-00926 8A
W83-00927 8A
W83-00928 8A
W83-00929 2J
W83-00930 2J
W83-00931 2J
W83-00932 2G
W83-00933 2J
W83-00934 2J
W83-00935 8B
W83-00936 8B
W83-00937 2J
W83-00938 2L
W83-00939 2L
W83-00940 2E
W83-00941 2L
W83-00942 8B
W83-00943 5D
W83-00944 5G
W83-00945 6B
W83-00946 4B
W83-00947 6D
W83-00948 3B
W83-00949 3B
W83-00950 7A
W83-00951 6E
W83-00952 6G
W83-00953 5B
W83-00954 5B
W83-00955 5C
W83-00956 5B
W83-00957 5C
W83-00958 5G
W83-00959 5G
W83-00960 5C
W83-00961 5B
W83-00962 3B
W83-00963 5A
W83-00964 2I
W83-00965 7B
W83-00966 8A
W83-00967 5C
W83-00968 5F
W83-00969 3A
W83-00970 8G
W83-00971 5C
W83-00972 5D
W83-00973 8D
W83-00974 8B
W83-00975 7A
W83-00976 2E
W83-00977 6F
W83-00978 5F
W83-00979 3A
W83-00980 3B
W83-00981 2H
W83-00982 2C
W83-00983 5G
W83-00984 7C
W83-00985 5B
W83-00986 2A
W83-00987 2F
W83-00988 2A
W83-00989 7C
W83-00990 7C
W83-00991 2E
W83-00992 3E
W83-00993 7C
W83-00994 7C
W83-00995 7C
W83-00996 7C
W83-00997 7C
W83-00998 7C
W83-00999 7C
W83-01000 7C
W83-01001 7C
W83-01002 7C
W83-01003 7C
W83-01004 2F
W83-01005 5G
W83-01006 7C
W83-01007 7C
W83-01008 4C
W83-01009 7C
W83-01010 7C
W83-01011 2H
W83-01012 5G
W83-01013 5F
W83-01014 4B
W83-01015 5F
W83-01016 5F
W83-01017 5F
W83-01018 5F
W83-01019 5A
W83-01020 5F
W83-01021 2F
W83-01022 2B
W83-01023 2K
W83-01024 3C
W83-01025 3B
W83-01026 3F
W83-01027 2F
W83-01028 2F
W83-01029 2H
W83-01030 5E
W83-01031 5G
W83-01032 5F
W83-01033 8A
W83-01034 5F
W83-01035 5G
W83-01036 5A

W83-01037

W83-01037 5D
W83-01038 2G
W83-01039 2E
W83-01040 2H
W83-01041 2F
W83-01042 6D
W83-01043 8A
W83-01044 5B
W83-01045 2J
W83-01046 2E
W83-01047 2F
W83-01048 2F
W83-01049 2F
W83-01050 2K

☆ U. S. GOVERNMENT PRINTING OFFICE : 1983 381-011/9

Subject Fields

1 NATURE OF WATER

2 WATER CYCLE

3 WATER SUPPLY AUGMENTATION AND CONSERVATION

4 WATER QUANTITY MANAGEMENT AND CONTROL

5 WATER QUALITY MANAGEMENT AND PROTECTION

6 WATER RESOURCES PLANNING

7 RESOURCES DATA

8 ENGINEERING WORKS

9 MANPOWER, GRANTS, AND FACILITIES

0 SCIENTIFIC AND TECHNICAL INFORMATION

INDEXES

SUBJECT INDEX

AUTHOR INDEX

ORGANIZATIONAL INDEX

ACCESSION NUMBER INDEX

NORTH AMERICAN CONTINENT PRICE SCHEDULE

Customers in Canada, United States, and Mexico please use this price schedule; other addressees, write for Folder PR-360-4.

MICROFICHE	
A01	$4.50
PAPER COPY	
A02	7.00
A03	8.50
A04	10.00
A05	11.50
A06	13.00
A07	14.50
A08	16.00
A09	17.50
A10	19.00
A11	20.50
A12	22.00
A13	23.50
A14	25.00
A15	26.50
A16	28.00
A17	29.50
A18	31.00
A19	32.50
A20	34.00
A21	35.50
A22	37.00
A23	38.50
A24	40.00
A25	41.50
A99	*

E01	$6.50
E02	7.50
E03	9.50
E04	11.50
E05	13.50
E06	15.50
E07	17.50
E08	19.50
E09	21.50
E10	23.50
E11	25.50
E12	28.50
E13	31.50
E14	34.50
E15	37.50
E16	40.50
E17	43.50
E18	46.50
E19	51.50
E20	61.50
E99	**
N01	35.00
N02	40.00

T01	$125.00
T02	140.00
T03	240.00
T04	320.00
T05	400.00
T06	465.00
T07	530.00
T08	595.00
T09	660.00
T10	725.00
T11	790.00
T12	855.00
T13	920.00
T14	985.00
T15	1,050.00
T16	1,115.00
T17	1,180.00
T18	1,245.00
T19	1,310.00
T99	**

*Add $1.50 for each additional 25-page increment, or portion thereof.
**Contact NTIS for price quote.

PRICES EFFECTIVE JANUARY 1, 1983

U.S. DEPARTMENT OF COMMERCE
National Technical Information Service
5285 Port Royal Road
Springfield VA 22161

OFFICIAL BUSINESS

PRINTED MATTER

AN EQUAL OPPORTUNITY EMPLOYER

POSTAGE AND FEES PAID
U.S. DEPARTMENT OF COMMERCE
COM 211
Special Fourth Class Rate
Book

U.S.MAIL

Doc.
I 1.94/2:
16/4

BOOKSTACKS-
DOCUMENTS

PB83-910204

DEPOSITORY

MAY 26 1983

UNIVERSITY OF ILLINOIS
AT URBANA-CHAMPAIGN

SELECTED WATER RESOURCES ABSTRACTS

VOLUME 16, NUMBER 4
APRIL 1983

W83-01051 -- W83-01400
CODEN: SWRABW

SELECTED WATER RESOURCES ABSTRACTS (SWRA) is produced by the Geological Survey, U.S. Department of the Interior, and published monthly by the National Technical Information Service (NTIS), U.S. Department of Commerce.

SWRA is available to Federal agencies and their contractors or grantees in water resources research upon request, citing contract or grant number and sponsoring agency. Write: Water Resources Division, U.S. Geological Survey, MS 421, Reston, VA 22092, U.S. Department of the Interior, Washington, DC 20240. The **SWRA Journal** is also available on subscription from NTIS, 5285 Port Royal Road, Springfield, VA 22161. Annual subscription rates for the North American Continent are:
Journal only, $100; Journal and Annual Indexes, $125; Indexes only, $50. Other addressees, write for prices.

Some documents abstracted in this journal can be purchased from NTIS. Price codes are given in the entries and a current code-price conversion table is printed on the outside back cover. Other documents are available from originating organizations or authors as indicated in the citation.

SELECTED WATER RESOURCES ABSTRACTS

A monthly publication of the Geological Survey
U.S. Department of the Interior

VOLUME 16, NUMBER 4
APRIL 1983

W83-01051 -- W83-01400

The Secretary of the Interior has determined that the publication of the periodical is necessary in the transaction of the public business required by law of this Department. Use of funds for printing this periodical has been approved by the Directory of the Office of Management and Budget through September 30, 1983.

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.

PREFACE

Selected Water Resources Abstracts, a monthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. These documents cover water resources as treated in the life, physical, and social sciences and the related engineering and legal aspects of the characteristics, supply condition, conservation, control, use, or management of water resources. Each abstract includes a full bibliographic citation and a set of descriptors which are listed in the **Water Resources Thesaurus.** The abstract entries are classified into 10 fields and 60 groups similar to the water resources research categories established by the Committee on Water Resources Research of the then Federal Council for Science and Technology.

Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientitsts, engineers, and managers as one of several services of the Water Resources Scientific Information Center. The cumulative SWRA file from 1968 and monthly updates are available also in magnetic tape through lease from NTIS.

THE WATER RESOURCES SCIENTIFIC INFORMATION CENTER DOES NOT PROVIDE COPIES OF DOCUMENTS ABSTRACTED IN THIS JOURNAL. Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources.

Comments and suggestions concerning the contents and arrangement of this bulletin are welcome.

Water Resources Scientific
Information Center
U.S. Geological Survey, MS 421
Reston, VA 22092

CONTENTS

SUBJECT FIELDS AND GROUPS

Please use the edge index on the back cover to locate Subject Fields and Indexes.

01 NATURE OF WATER

Includes the following Groups: Properties; Aqueous Solutions and Suspensions.

02 WATER CYCLE

Includes the following Groups: General; Precipitation; Snow, Ice, and Frost; Evaporation and Transpiration; Streamflow and Runoff; Groundwater; Water in Soils; Lakes; Water in Plants; Erosion and Sedimentation; Chemical Processes; Estuaries.

03 WATER SUPPLY AUGMENTATION AND CONSERVATION

Includes the following Groups: Saline Water Conversion; Water Yield Improvement; Use of Water of Impaired Quality; Conservation in Domestic and Municipal Use; Conservation in Industry; Conservation in Agriculture.

04 WATER QUANTITY MANAGEMENT AND CONTROL

Includes the following Groups: Control of Water on the Surface; Groundwater Management; Effects on Water of Man's Nonwater Activities; Watershed Protection.

05 WATER QUALITY MANAGEMENT AND PROTECTION

Includes the following Groups: Identification of Pollutants; Sources of Pollution; Effects of Pollution; Waste Treatment Processes; Ultimate Disposal of Wastes; Water Treatment and Quality Alteration; Water Quality Control.

06 WATER RESOURCES PLANNING

Includes the following Groups: Techniques of Planning; Evaluation Process; Cost Allocation, Cost Sharing, Pricing/Repayment; Water Demand; Water Law and Institutions; Nonstructural Alternatives; Ecologic Impact of Water Development.

07 RESOURCES DATA

Includes the following Groups: Network Design; Data Acquisition; Evaluation, Processing and Publication.

08 ENGINEERING WORKS

Includes the following Groups: Structures; Hydraulics; Hydraulic Machinery; Soil Mechanics; Rock Mechanics and Geology; Concrete; Materials; Rapid Excavation; Fisheries Engineering.

09 MANPOWER, GRANTS, AND FACILITIES

Includes the following Groups: Education—Extramural; Education—In-House; Research Facilities; Grants, Contracts, and Research Act Allotments.

10 SCIENTIFIC AND TECHNICAL INFORMATION

Includes the following Groups: Acquisition and Processing; Reference and Retrieval; Secondary Publication and Distribution; Specialized Information Center Services; Translations; Preparation of Reviews.

SUBJECT INDEX

AUTHOR INDEX

ORGANIZATIONAL INDEX

ACCESSION NUMBER INDEX

SELECTED WATER RESOURCES ABSTRACTS

1. NATURE OF WATER

1A. Properties

SATURATED VAPOR PRESSURE OF WATER AND ACTIVITY COEFFICIENTS OF CALCIUM CHLORIDE IN THE CACL2-H20 SYSTEM AT 423-623K,
Leningrad Technological Insti. (USSR).
V. I. Zarembo, S. N. L'vov, and M. Yu. Matuzenko.
Geochemistry International, Vol 17, No 2, p 159-162, 1980. 3 Fig, 3 Tab, 7 Ref.

Descriptors: *Vapor pressure, *Calcium chloride, *Activity coeffieient, Water vapor, Geochemistry, Physical properties, Temperature effects, Electrolytes.

The saturated vapor pressure of water and the activity coefficients of CaCl2 in CaCl2-H20 systems were determined with a new high pressure autoclave design which measures the temperature of the test liquid more accurately than previous equipment. The saturated water vapor pressures of pure water at tempertures of 415.91 to 624.71 K ranged from 0.3906 to 16.849 MPa and agreed closely with data reported in the literature. The saturated vapor pressures above aqueous solutions of CaC12 were reported for 7 concentrationss (0.246 to 5.536 mol per 100 g water) and temperatures of 423, 473, 523, and 623 K. These ranged from 0.47 MPa at the lowest concentration and temperature to 12.95 Mpa at the highest concentration and temperature. Mean molar activity coefficeients of CaC12 in the system (0.25 to 5.56 mol per 100 g H20) at the same temperatures ranged from 0.344 at the lowest concentration and temperaure to 0.005 at the highest concentration and temperature. (Cassar-FRC)
W83-01250

1B. Aqueous Solutions and Suspensions

SATURATED VAPOR PRESSURE OF WATER AND ACTIVITY COEFFICIENTS OF CALCIUM CHLORIDE IN THE CACL2-H20 SYSTEM AT 423-623K,
Leningrad Technological Insti. (USSR).
For primary bibliographic entry see Field 1A.
W83-01250

2. WATER CYCLE

2A. General

APPLICATION OF SACRAMENTO RIVER FORECAST MODEL TO AN INDIAN CATCHMENT,
Meteorological Office, New Delhi (India).
S. K. Gosain, and S. D. S. Abbi.
Mausam, Vol 31, No 1, p 55-64, January, 1980. 6 Fig, 1 Tab, 4 Ref.

Descriptors: *Model studies, Rivers, *Forecasting, *River forecasting, Catchment areas, Catchment basins, Watersheds, River basins, *Sacramento River Forecast Model, *India, Yamuna catchment.

The Sacramento model, a conceptual watershed model, has been applied successfully to the upper Yamuna catchment for runoff simulation at the Kalanaur outlet point. The model enables the calculation, in six-hourly values, of water transfer (interception, evapotranspiration, percolation), of the state of different phases of the water cycle, and of the flow at the outlet of the area (direct runoff, surface runoff, interflow and baseflow). Mathematical functions used in the model formulation in order to represent the physical processes taking place in the catchments, have been described in detail. The physical description of various model parameters and methods of their evaluation are also given. (Baker-FRC)
W83-01386

APPLICATION OF DETERMINISTIC CONCEPTUAL MODEL FOR WATER BALANCE STUDIES,
Meteorological Office, New Delhi (India).
S. D. S. Abbi, A. K. Gosain, and P. Narayanan.
Mausam, Vol 31, No 2, p 191-200, April, 1980. 2 Fig, 9 Tab, 2 Ref.

Descriptors: *Model studies, *Hydrologic budget, *Soil moisture, Moisture availability, Runoff, Sacramento Model, *India, Dandavathy, Tungabadhara River Basin, River basins, Mathematical equations.

A study was made of the water balance of Dandavathy, a tributary of the Tungabadhara river basin in Karnataka. The Sacramento model, a deterministic conceptual model, was applied for the study. In this technique precipitation and evaporation data have been used to allocate the moisture in various layers of the soil; the resultant runoff was compared with the actual runoff for the purpose of the calibration of the model. The model was then used to study the water balance by the well known hydrologic equation, and the results were found to be very encouraging. (Baker-FRC)
W83-01387

2B. Precipitation

RADAR AND RAINGAUGE OBSERVATIONS OF OROGRAPHIC RAIN OVER SOUTH WALES,
Royal Signals and Radar Establishment, Malvern (England). Meteorological Office Radar Research Lab.
F. F. Hill, K. A. Browning, and M. J. Bader.
Quarterly Journal of the Royal Meteorological Society, Vol 107, No 453, p 643-670, July, 1981. 19 Fig, 3 Tab, 9 Ref.

Descriptors: *Orographic precipitation, *Weather, Rainfall Precipitation, Geography, *Wales, Model studies, Wind, *Radar, *Rain gages.

The Structure and mechanism of orographically enhanced frontal rain over hills of modest height are discussed using eight detailed case studies. The observations were obtained as part of a field project in south Wales in which data from a 3-dimensionally scanning radar system were combined with autographic rain gauge data. The results demonstrate that the generation of orographic rain is consistent with Bergeron's seeder-feeder mechanism, according to which raindrops from upper-level (seeder) clouds wash out small droplets within low-level (feeder) clouds formed over the hills. It is demonstrated that the orographic enhancement is strongly influenced by the low-level wind speed. The largest enhancement of rainfall occurred in association with strong winds, and also high relative humidity, below 2 km. The radar showed that over 80% of the enhancement occurred in the lowest 1.5 km above the hills. It also showed that the periods of enhanced rainfall were associated with the passage of pre-existing areas of precipitation. The precise value of the upwind rainfall rate was rather unimportant in influencing the orographic increment provided the rainfall rate upwind exceeded about 0.5 mm/hr. These findings are compared with the results of theoretical calculations based upon the washout model of Bader and Roach. (Baker-FRC)
W83-01061

COMPARATIVE STUDY AND CALIBRATION OF SENSORS FOR THE MEASUREMENT OF THE LIQUID WATER CONTENT OF CLOUDS WITH SMALL DROPLETS,
Clermont Univ., Aubiere (France).
For primary bibliographic entry see Field 7B.
W83-01091

RAINDROP AXIAL RATIOS,
Illinois Inst. of Natural Resources, Champaign.
A. R. Jameson, and K. V. Beard.
Journal of Applied Meteorology, Vol 21, No 2, p 257-259, February, 1982. 2 Fig, 19 Ref.

Descriptors: *Rain, *Shape, Radar, Axial ratios, Polarization, Oscillation, Data interpretation, Remote sensing, Rainfall, Raindrops.

The equilibrium axial ratios of naturally falling raindrops varied from 0.70 to 1.46, mean 1.08, indicating a spherical, slightly prolate shape. This differed from previous reports of the equilibrium slope of raindrops in a laminar flow wind tunnel or still air. These drops had mean axial ratios on the order of 0.8, indicating a more oblate shape. The deviations can affect results of radar polarization measurements in rain, which depend on assumed drop shapes. (Cassar-FRC)
W83-01092

PRECIPITATION DATA FOR BURIAL GROUNDS 5 AND 6, OAK RIDGE NATIONAL LABORATORY, TENNESSEE, 1976-1980,
Geological Survey, Knoxville, TN. Water Resources Div.
For primary bibliographic entry see Field 7C.
W83-01183

RAINFALL VARIATION ANALYSIS AND OPTIMIZATION OF GAGING SYSTEMS,
Agricultural Research and Education Center, Belle Glade, FL. Dept. of Agricultural Engineering.
S. F. Shih.
Water Resources Research, Vol 18, No 4, p 1269-1277, August, 1982. 4 Fig, 6 Tab, 13 Ref.

Descriptors: *Rainfall, *Variation analysis, *Gaging, Gaging stations, Gages, *Rainfall distribution, *Rain gages, Water resources development.

A general methodology is developed to compute the variance of mean rainfall using a covariance factor among rain gage stations. The relative variance, which can be reduced by increasing the density of the network, is presented as three cases: random sample method, stratified sample method without optimum allocation, and stratified sample method with optimum allocation. A special stratum-weighted ratio is also developed for allocating the gages to the substratum. On the basis of two-stage sampling theory, new methods are developed to decide the number of gages needed to estimate the mean rainfall with a given confidence level to achieve a specified accuracy. The stratified sample method required fewer stations to achieve the same level of statistical accuracy compared to the random method. In designing the rain gage network system, three steps are involved: preliminary design, allocation of the gages to substratum, and improvement of the gage density according to the expected level of statistical accuracy. Three classes with low, medium, and high density of rain gage network design are recommended in accordance with the desired level of statistical accuracy. A nonlinear relationship prevails between the increase in number of gages and the improvement in statistical accuracy. (Baker-FRC)
W83-01202

HIGH INTENSITY RAINFALLS IN NZ,
Ministry of Works and Development, Christchurch (New Zealand).
A. I. Tomlinson.
Soil and water, Vol 16, No 3, p 22-23, June, 1980. 2 Fig.

Descriptors: *Rainfall intensity, *Frequency analysis, *Prediction, *New Zealand, Weather data collections, Weather, Rainfall, Storms.

The Meteorological Service and the Water and Soil Division of the Ministry of Works and Development recently set about a joint project to produce a set of up to date figures giving the frequency of high intensity rainfalls in New Zealand. From time to time extreme rainfalls occur which are claimed to be, for example, 1000 yr falls. Two factors must considered. First, if a rainfall is claimed to have a 1000 year return period, this means that the fall will be equalled or exceeded on the average of once every 1000 years. This implies a knowledge of what will happen once every 1000 years on the basis of rainfall measurements over the last 100 years or so. Such a claim is subject to

very large uncertainty. Secondly, 1000 year return period rainfalls, or those claimed to be of this variety, seem to occur too often. This is because the statistical procedures used to compute the size of rainfalls of return periods up to 100 years do not apply to the very extreme rainfalls. In order to get an estimate of the upper limit for rainfalls of return periods of more than 100 years, one can examine the maximum recorded rainfalls throughout New Zealand. Events in recent years may lead one to think that extreme rainfalls are becoming more frequent. (Baker-FRC)
W83-01295

TECHNICAL MANUAL FOR GROUNDWATER EXPLORATION IN ARID AND SEMIARID REGIONS USING LANDSAT VISUAL AND DIGITAL ANALYSES,
Greenhorne and O'Mara, Inc., Riverdale, MD.
For primary bibliographic entry see Field 7A.
W83-01356

DIURNAL VARIATION OF RAINFALL IN THE UPPER CATCHMENTS OF NORTH BENGAL RIVERS,
Flood Meteorological Office, Jalpaiguri (India).
P. K. Bhattacharya, and S. G. Bhattacharyya.
Mausam, Vol 31, No 1, p 51-54, January, 1980. 1 Fig, 2 Tab, 6 Ref.

Descriptors: *Rainfall, *Diurnal distribution, *Catchments, Rainfall distribution, Monsoons, Distribution, *India, Rivers, Bengal, Wind.

A study was made of the diurnal variation of the rainfall during the monsoon season at six selected stations in upper catchment areas of four north Bengal rivers, the Teesta, Jaldhaka, Torsa and Raidak. The study period was from 1971 to 1976. The different patterns of diurnal variation which were observed are reported. The study clearly indicates that there is a marked tendency toward occurrence of heaviest falls during night/early morning hours in the months from June to September at all the stations except Darjeeling. Therefore, the upper catchment areas may be expected to receive more water to convert to effective runoff during the night/early morning hours of the monsoon months. It appears that at the height of the monsoon when the moisture content in the air is high, the mechanism of rainfall may be influenced by katabatic flow in the night. Radiation cooling at the top of the cloud may also be helpful in accentuating the convective activity during the night. The absence of a pronounced maximum during the night at Darjeeling may be due to the fact that the station is situated on the leeward side of the hill with respect to the monsoon current, and the kattabatic flow is not in opposition to the current. (Baker-FRC)
W83-01377

2C. Snow, Ice, and Frost

SNOW STRATOGRAPHY AND WATER EQUIVALENCE MEASURED WITH AN ACTIVE MICROWAVE SYSTEM,
National Bureau of Standards, Boulder, CO. National Engineering Lab.
D. A. Ellerbruch, and H. S. Boyne.
Journal of Glaciology, Vol 26, No 94, p 225-233, 1980. 8 Fig, 1 Tab, 11 Ref.

Descriptors: *Snowpack, *Stratigraphy, Physical properties, Snow cover, Sensors, Water resources development, Glaciology, *Water equivalence, Radiation, Density, Hardness, Moisture content, *Microwave measurement.

The use of an active microwave system to determine the water equivalence and stratigraphic layering of snow-pack is described. Indications of substantial near surface activity and the possibility of identifying a characteristically weak layer, called the depth-hoar layer, in the snow-pack are also reported. An FM-CW active microwave radar system operating in the frequency range 8-12 GHz is used to scatter electromagnetic radiation from surface and subsurface stratigraphic layers in the snow-pack. The amplitude of the scattered radiation as a function of depth in the snow-pack can be correlated with such physical characteristics as density, hardness, stratigraphy, and moisture content. A direct determination of snow-pack water equivalence can be made from these observations. The same procedure can be used to measure snow-pack loading (change in electrical depth) on an avalanche slope. Evidence suggests that the top of the depth-hoar layer exhibits a strong reflection which can be monitored during the snow season. There is also evidence that while the physical depth of the pack diminishes in the latter part of the season, the water equivalence remains relatively constant (densification). Finally there is evidence that the ripeness of the snow-pack could be assessed by observing the diminution of stratigraphic layers in the late season snow pack. (Baker-FRC)
W83-01060

ANALYSIS OF FREEZE-UP ICE JAMS ON THE PEACE RIVER NEAR TAYLOR, BRITISH COLUMBIA,
British Columbia Hydro and Power Authority, Vancouver. Hydroelectric Generation Projects Div.
T. Keenhan, U. S. Panu, and V. C. Kartha.
Canadian Journal of Civil Engineering, Vol 9, No 2, p 176-188, June, 1982. 9 Fig, 6 Tab, 7 Ref.

Descriptors: *Rivers, *Ice jams, *Dams, Bennett Dam, Ice formation, Peace River, *British Columbia, Canada, Temperature effects, Water temperature, Powerplants.

A description is offered of the ice jamming mechanism observed during the ice cover advance on the Peace River downstream of the W.A.C. Bennett Dam and the adjoining G.M. Shrum Generating Station. The levels of ice recorded at the jams and the results of analyses using models are presented. Since the Dam was constructed on the Peace River, the temperature of flow releases from the generating station has been 0.5 C or higher during the winter months. As a result the progression of ice cover below the dam is inhibited, and a long reach of ice-free river persists throughout the winter. During February, 1979, below normal air temperatures persisted in the area; the cover progressed to a point 130 km downstream of the dam, 19 km upstream of the Water Survey of Canada stream gauge at Taylor. This was only the second occurrence of ice cover at the town of Taylor since 1972, when an increase in generating capacity at the station raised maximum powerhouse releases to 1580 cu m/sec. A series of ice jams at the leading edge of the ice cover formed as the cover advanced, producing water levels at Taylor that approached the maximum historic summer flood levels. The ice movement, including ice cover advance and retreat, ice levels, and jam formation, were monitored and documented. The data provided an opportunity to examine various river ice simulation models and assess their applicability to the Peace River. (Baker-FRC)
W83-01103

GEOCHEMICAL DENUDATION RATES AND SOLUTE TRANSPORT MECHANISMS IN A MARITIME TEMPERATE GLACIER BASIN,
Toronto Univ. (Ontario). Dept. of Geology.
N. Eyles, D. R. Sasseville, R. M. Slatt, and R. J. Rogerson.
Canadian Journal of Earth Sciences, Vol 19, No 8, p 1570-1581, August, 1982. 2 Fig, 8 Tab, 43 Ref.

Descriptors: *Geochemistry, *Glaciers, *Solute transport, Basins, Cations, Copper, Chromium, Lead, Nickel, Trace metals, Berendon Glacier, Canada, Aeolian deposits, Mining, Milling, Cascade Range, *British Columbia, Calcium, Ion transport.

Cation and silica transport in supraglacial, subglacial, and valleyside waters from a temperate glacier fluvial system in British Columbia is reported. Dissolved cation loss from the basin of Berendon Glacier is calculated at 947 mequiv/sq meter/yr, with calcium accounting for nearly all of this loss. The geochemical denudation rate is substantially greater than the world average of 390 equiv/sq m/yr, but agrees with similar studies from the Cascade Range in the U.S. Abundant precipitation is probably responsible for the significant geochemical denudation, despite reduced chemical activity at low annual temperatures. When absorption is considered in the removal process, the major cation denudation rate increases by about 10% and doubles the loss of certain cations such as sodium. Debris-water contact time appears to exert a significant control on the cation and silica concentrations exhibited by the various water types moving through the basin. Firn, glacier ice, and supraglacial streams generally possess the lowest ionic concentrations, and subglacial streams, valleyside streams, and ponds generally contain the highest. Anthropogenic chemical input to the Berendon basin is measurable and consists of trace metal rich dust originating at a mining and milling operation close to the glacier terminus. Aeolian transport is responsible for distributing Cu, Cr, Ni, and Pb throughout the watershed. (Baker-FRC)
W83-01109

2D. Evaporation and Transpiration

SURFACE LAYERS OF AIR AND WATER AND THEIR ROLE IN HEAT AND MOISTURE EXCHANGE BETWEEN A WATER BODY AND THE ATMOSPHERE,
Akademiya Nauk SSSR, Moscow. Inst. Vodnykh Problem.
G. M. Panin.
Water Resources, Vol 8, No 5, p 483-493, September-October, 1981. 7 Fig, 1 Tab, 25 Ref. Translated from Vodnye Resursy, No 5, p 45-57, September-October, 1981.

Descriptors: *Air temperature, *Water temperature, *Mathematical studies, *Heat transfer, *Mathematical models, *Specific humidity, *Moisture gradient, Surface water records, Mathematical equations, Seasonal variation, Diurnal distribution, Heat flow, Humidity, Evaporation, Baltic Sea, Caspian Sea.

Certain complications prevent the widespread use of fluctuation and gradient methods for determining the heat and moisture exchange between a water surface and the atmosphere under natural conditions, so that empirical formulas must be used. However, terms for the changes in air temperature and specific humidity in these formulas present some confusion. Since gradients of temperature and humidity should not depend on height, the equations can be rewritten to include dimensionless universal functions. Since the functions for air temperature and relative humidity coincide, only the function of temperature was examined from direct measurements. To determine the form of the function, data from a field study carried out on the Baltic Sea cost and from studies done in the open part of the Caspian Sea were used. In the case of the heat flux between the surface layer of water and the air, three types of temperature distributions were found in the surface layer of the water. These three types of distribution become important in comparing temperature measurements taken from ships and satellites. The implications of seasonal and diurnal variations on the use of these relationships are discussed. (Geiger-FRC)
W83-01113

CANOPY AIR TEMPERATURES AND EVAPOTRANSPIRATION FROM IRRIGATED AND STRESSED SOYBEANS,
Science and Education Administration, Morris, MN.
D. C. Reicosky, D. E. Deaton, and J. E. Parsons.
Agricultural Meteorology, Vol. 21, No. 2, p 21-35, January, 1980. 9 Fig, 1 Tab, 16 Ref.

Descriptors: Soil-water-plant relationships, *Irrigation requirements, *Air temperature, *Evapotranspiration, Transpiration, *Water stress, *Irrigation efficiency, Soil water, Moisture stress, Crop production, Trickle irrigation, Canopy, *Soybeans, Wilting.

When soil-water stress is severe, partial closure of plant stomates causes a repartioning of the incident energy, which often increases canopy air temperatures. The relationship of soil-water stress to air temperatures and evapotranspiration was examined in crops of irrigated and non-irrigated soybeans. Air temperature profiles were measured using calibrated thermistors and evapotranspiration was measured by portable chamber. Plant-water status was measured indirectly by linear variable displacement transducers. Measured stem-diameter changes were related to air temperature differences in the irrigated and non-irrigated canopies. Results showed as soil-water stress became more severe, canopy air temperatures in non-irrigated crops increased above those in irrigated crops. The above-canopy minus the within-canopy temperature differences between irrigated and non-irrigated fields increased during peak radiation with little change at night. During severe stress, evapotranspiration decreased 40-70% when within-canopy air temperature was related to stem-diameter shrinkage and may act as an indirect measure of plant-water status to calculate irrigation requirements under field conditions. (Geiger-FRC)
W83-01313

2E. Streamflow and Runoff

LABORATORY INVESTIGATION OF THE STRUCTURE OF THE FLOW AND BOTTOM FEATURES IN RIVER MOUTH REGIONS,
Moscow State Univ. (USSR). Hdrophysical Lab.
O. P. Petrosyan, and V. G. Ponomarenko.
Water Resources, Vol 8, No 5, p 542-545, September-October, 1981. 4 Fig, 1 Tab, 3 Ref. Translated from Vodnye Resursy, No 5, p 121-125, September-October, 1981.

Descriptors: *Slope stability, *Estuaries, *Flow pattern, *Morphology, *Fluctuations, *Mathematical studies, *Mathematical models, *Deformation, *River mouth, Slope degradation, Model studies, Slopes, Channel morphology, Flow characteristics, Bottom currents, Flow velocity, Rheology.

A model of a river mouth region was devised in the Hydrophysical Laboratory of the Moscow State University to study flow patterns and bottom features. Within hours after the start of the experiment, deformations of the bottom and slopes showed the formation of a crescent shape characteristic of mouth regions. Stabilization of the cross section in the mouth part of a canal was more prolonged compared to stabilization of the channel. An increase was observed in the standard deviation of fluctuations during formation of a ridge relief along the axis of the mouth segment of a canal. A relationship was noted between the scales of the energy-transporting eddies in turbulent flows measured near the bottom and the relief features. The scale of turbulent formations in the flow increased from the bottom to the surface and also from the beginning to the end of the experiment. (Geiger-FRC)
W83-01099

MAGNITUDE AND FREQUENCY OF FLOODS FROM SELECTED DRAINAGE BASINS IN SOUTH DAKOTA,
Geological Survey, Huron, SD. Water Resources Div.
For primary bibliographic entry see Field 4A.
W83-01193

WATERSHEDS IN MUSKEG TERRAIN. 1. THE CHEMISTRY OF WATER SYSTEMS,
Alberta Univ., Edmonton. Dept. of Geology.
For primary bibliographic entry see Field 2K.
W83-01206

THE INFLUENCE OF LOW-ANGLED TOPOGRAPHY ON HILLSLOPE SOIL-WATER CONVERGENCE AND STREAM DISCHARGE,
Bristol Univ. (England). Dept. of Geography.
For primary bibliographic entry see Field 2G.
W83-01213

PASSAGE OF FLOODS OVER RIVER FLOODPLAINS,
M. M. Gendel'man.
Hydrotechnical Construction, Vol. 15, No. 11, p 692-697, 1981-1982. 6 Fig, 2 Tab, 5 Ref. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 11, p 32-36, November, 1981.

Descriptors: *Runoff, *Model studies, *Flood profiles, *Indirect flood measurement, Mathematical studies, *Flood flow, *Topography, River forecasting, Flood routing, Flood plain management, Flow around objects, Forests, Terrain analysis, Flood plains, *USSR.

Factual information on river runoff, shows that methods of hydraulic calculations of the characteristics of flood-plain flow are not sufficiently reliable. Incorrect calculation of hydraulic resistance of the channel and flood plain may lead to substantial errors in most cases. To correct this problem, physical modeling was examined for studying the passage of floods over the floodplain of a large meandering river. The model was based on the premise that the flow in the prototype and model obey a power-function relationship between the Chezy coefficient and the Reynolds number. The model was made from and following contour lines. The upper 2-3 cm of the model were formed of concrete with a coordinate grid plotted on the surface. The model was equipped with a weir for measuring flow delivery, a baffle wall for dissipating the excess energy of mixing, point gauges for measuring the water level, a settling basin, a gate for regulating the depth, and an outlet. Three series of experiments corresponding to floods of 0.01, 0.1 and 1% probability were carried out. Comparatively low values for Froude number and rather larger values for Reynolds numbers provided at least a quantitative similarity of the model flow to the prototype. Results of studies simulating a forest terrain showed that the effects of the forest on the discharge capacity of the floodplain and channel are minimal in comparison to the effects of complex planar forms and morphological elements. On the basis of the conditions of the model floodplain flow regime, an appropriate site for the location of a hydrostation was recommended. (Geiger-FRC)
W83-01233

THE DYNAMICS OF A RIVER BEND: A STUDY IN FLOW AND SEDIMENTARY PROCESSES,
State Univ. of New York at Binghamton. Dept. of Geological Sciences.
J. S. Bridge, and J. Jarvis.
Sedimentology, Vol 29, No 4, p 499-541, August, 1982. 34 fig, 105 Ref.

Descriptors: *Flow characteristics, *Sedimentation, *Rivers, Flow profiles, Hydraulics, Hydrodynamics, Sediment transort, Fluid mechanics, *Scotland, River South Esk.

Stable scaffolding bridges spaced along the length of a bend of the River South Esk in Scotland were used to take comprehensive field measurements of flow and sedimentary processes. At river stages between about two-thirds full and bankfull, channel width, mean depth and mean flow velocity at a cross-section vary little in the streamwise direction. Flow resistance reached a maximum at these states, and the bed topography was stable and in equilibrium with flow and bedload transport. Stable flow geometry is thus related to energy conservation and to maximization of flow resistance. Detailed observations over a large range of river stages of mean velocity distributions, secondary, circulation, water surface configuration, bed shear stress and resistance to flow, bed configurations and bed load transport rates agree with much of the comparable published studies and theoretical works. Generalized physical models of flow and sediment transport in natual curved channels are demonstrated to be sound in basis and can simulate the bend studied very well. While there is a pressing need for further development of these models, the results lend confidence to their use in simulating ancient river sedimentation. Sediment deposited on point bars is the result mainly of bedload transort over a range of near-bankfull stages. The areal distribution of grain-size characteristics and bed configurations at these stages gives rise, with lateral deposition, to vertical facies sequences that vary substantially in the streamwise direction. (Baker-FRC)
W83-01249

STATISTICAL CHARACTERISTICS OF SOME INDIAN HYDROLOGIC TIME SERIES,
Purdue Univ., Lafayette, IN. School of Civil Engineering.
A. R. Rao.
Mausam, Vol 31, No 2, p 273-286, April, 1980. 13 Fig, 9 Ref.

Descriptors: *Hydrologic systems, *River flow, *Model studies, Tropical regions, Temperate zone, Climatic zones, *India, Krishna River, Godavari River, Wabash River, Monsoons, *Statistical methods, *Indiana.

The characteristics of the monthly and annual river flows from the Krishna and Godavari Rivers in south India, and the corresponding precipitation data from several stations in the Krishna and Godavari river basins are analyzed and compared with similar data from the Wabash River. The rivers are located in the tropical monsoon region. It was concluded that the monthly flows of these two rivers are highly seasonal and cannot be considered as weakly stationary. The annual flows may be considered as weakly stationary processes. There is a much larger variability in the monthly and annual flows of Krishna and Godavari rivers compared to the Wabash river flow. The latter river is located in the temperate zone. The histograms of the monthly flows of all three rivers are highly skewed and cannot be considered to be Gaussian. The annual flow histograms are much more symmetrical. The second order properties of the Krishna and Godavari river flows are very similar to those of rainfall in the Krishna and Godavari river basins. This similarity was less evident for the data from the Wabash river basin. (Baker-FRC)
W83-01385

2F. Groundwater

AN ASSESSMENT OF THE IMPORTANCE OF SOME PARAMETERS FOR SEAWATER INTRUSION IN AQUIFERS AND A COMPARISON OF DISPERSIVE AND SHARP-INTERFACE MODELLING APPROACHES,
James Cook Univ. of North Queensland, Townsville (Australia).
R. E. Volker, and K. R. Rushton.
Journal of Hydrology, Vol 56, No 3/4, p 239-250, April, 1982. 7 Fig, 24 Ref.

Descriptors: *Saline-freshwater interfaces, *Saline water intrusion, Coastal aquifers, Aquifers, Groundwater movement, Model studies, Dispersion coefficient.

The location and shape of the steady interface in a coastal aquifer discharging fresh water into the sea are considered. For homogeneous isotropic aquifers the interface location is obtained by the boundary integral method for an abrupt interface model, which assumes that salt water and fresh water are immiscible fluids. Results from this model and miscible fluid models are compared for a variety of aquifer parameter values. The influence of controlling parameters on the shape and location of the interface is examined. For a given fresh water discharge, a decrease in the dispersion coefficient causes a contraction of the zone of dispersion and an upstream migration of the concentration contours near the aquifer base. For a constant dispersion coefficient, the interface becomes more diffuse and migrates inland as the fresh water discharge decreases. The relative density of seawater influences the length of intrusion into the aquifer. The width of the dispersion zone also increases with greater densities. The mean concentration contour line approaches that of the abrupt interface model when the dispersion coefficient decreases and the dispersion zone reduces in width. These conditions are valid for a constant

scalar dispersion coefficient. The same general trends also occur for a tensorial dispersion coefficient with velocity-dependent components. (Cassar-FRC)
W83-01051

GROUNDWATER BUILDUP AND DEPLETION IN ISLANDS DURING MONSOON AND SUMMER,
Center for Water Resources Development and Management, Calcutta (India). Groundwater Div.
P. Basak.
Journal of Hydrology, Vol 56, No 3/4, p 265-275, April, 1982. 7 Fig, 1 Tab, 6 Ref.

Descriptors: *Water table fluctuations, *Groundwater potential, *Islands, Groundwater level, Monsoons, Drought, Evaporation, Groundwater recharge, Recharge, *India, Reservoirs, Deltas, Aquifers, Unconfined aquifers.

Long- and short-term predictions of groundwater potential in unconfined aquifers in freshwater islands are described by closed-form analytical solutions. Solutions are obtained using Grinisky's potential and Dupuit's assumptions. Results are given in non-dimensional form. Typical locations to which these solutions are applicable are islands in reservoirs in Kerala, India, and southern Ganges delta of West Bengal, and southern Bangladesh. In these islands uniform recharge during the monsoons and uniform evaporation during prolonged droughts are prevailing conditions. (Cassar-FRC)
W83-01052

SIMILARITY SOLUTIONS OF THE POROUS MEDIA EQUATION,
Waterloopkundig Lab, Delft (Netherlands).
B. H. Gilding.
Journal of Hydrology, Vol 56, No 3/4, p 251-263, April, 1982. 1 Tab, 19 Ref.

Descriptors: *Porous media, *Groundwater movement, *Differential equations, Mathematical equations, Similarity solutions.

The porous media equation, a nonlinear partial differential equation, is used in groundwater hydrology. This paper applies a technique for determining admissable similarity transformations of this equation. The method used for the identification of admissible similarity transformations is an extension of the separation of variables technique. The transformations reduce the partial differential equations to an ordinary differential equation. These transformations produce three classes of similarity solutions from which the known explicit analytical solutions of the porous media equation may be obtained as special cases. (Cassar-FRC)
W83-01058

DECOLORIZATION OF INFILTRATION WATER UNDER NATURAL CONDITIONS,
Akademiya Nauk SSSR, Moscow. Inst. Biologii Vnutrennykh Vod.
B. A. Skopintsev.
Water Resources, Vol 8, No 5, p 558-570, September-October, 1981. 1 Fig, 7 Tab, 52 Ref. Translated from Vodnye Resursy, No 5, September-October, 1981.

Descriptors: *Color, *Groundwater runoff, *Surface runoff, *Podzols, *Humic acids, *Fulvic acids, *Organic matter, *Coagulation, Water treatment, Optical properties, Groundwater pollution, Soil types, Groundwater movement, Decomposing organic matter, Soil organic matter, Organic compounds, Separation techniques.

The content of organic matter in groundwater was studied in relation to coloration. During periods of precipitation or floods, surface waters are characterized by high color values, whereas groundwaters are usually faintly colored. If the average contribution of groundwaters to the total annual runoff is 16-24%, then the contribution of overland waters is 2-3 times more, according to data taken from 33 small rivers of the USSR. Humic acid compounds are the predominant organic compound in precipitation runoff. Fulvic acid is known to form organometallic complexes, especially in podzolic soils. Colored and turbid surface waters must be treated by coagulation with aluminum sulfate before practical use. If groundwaters are connected with perched or swamp waters or polluted water, their color and oxidizability increase. Various studies involving the extraction and fractionation of humic and fulvic acids from soils are reviewed. The variability of the ratio of the contents of humic acids/fulvic acids in different soils and the different mobility of these acids is due to hydrothermal factors which depend on the climate of different natural physiographic zones. The water regime of soils is also important in determining the ratio of these acids. Bacteria also may produce acids in soil. The differences between color formation in chernozem and podzolic soils are discussed. Organic matter of atmospheric waters that pass through the illuvium and enter groundwaters is characterized by the faintly colored fulvic acid fractions. (Geiger-FRC)
W83-01097

ISOTOPE HYDROGEOLOGY AND GEOTHERMOMETRY OF THE MOUNT MEAGER GEOTHERMAL AREA,
Waterloo Univ. (Ontario). Dept. of Earth Sciences.
I. D. Clark, P. Fritz, F. A. Michel, and J. G. Souther.
Canadian Journal of Earth Sciences, Vol 19, No 7, p 1454-1473, July, 1982. 10 Fig, 5 Tab, 46 Ref.

Descriptors: *Geothermal resources, *Sulfates, *Hydrothermal studies, Physical properties, Thermal properties, Isotopes, Resources development, Natural resources, Groundwater, Volcanoes, Thermal water, Mount Meager, *British Columbia.

A survey of stable and radioactive environmental isotopes has been carried out to investigate the recharge, thermal history, age and geothermometry of the thermal waters at Mount Meager, British Columbia, a Quaternary volcano that is currently the site of geothermal resources exploration. Chemical and isotope data indicate that the Meager Creek and the Pebble Creek thermal waters discharge from different geothermal systems. The majority of cold springs at Mount Meager discharge from seasonally variable, shallow flow systems and show a correlation between altitude and lighter isotope contents. Most cold groundwaters collected during this study contained measurable amounts of tritium, which shows that a large proportion of these waters is less than about 20 years old. Reservoir temperatures as estimated from the geochemical and isotopic geothermometers consistently indicate that the known Meager Creek and Pebble Creek thermal waters have experienced only moderate heating. Such evidence also indicates that the thermal waters of the two creeks are part of separate, shallow circulating geothermal systems. Recently a new drilled geothermal well has encountered temperatures close to 250 C at an approximate depth of 2400 m. This indicates that a significant heat source may exist which would support the conclusion that the chemistries and isotopic compositions of the springs sampled for this study do not reflect the resource potential at Mount Meager. (Baker-FRC)
W83-01102

MAP OF WATER TABLE IN SOLOMON RIVER VALLEY, WACONDA LAKE TO SOLOMON, NORTH-CENTRAL KANSAS, MAY 1980,
Geological Survey, Lawrence, KS. Water Resources Div.
For primary bibliographic entry see Field 7C.
W83-01180

MAP OF WATER TABLE IN GRAHAM COUNTY, NORTHWESTERN KANSAS, MARCH 1979,
Geological Survey, Garden City, KS. Water Resources Div.
For primary bibliographic entry see Field 7C.
W83-01181

GROUND-WATER QUALITY AND DATA ON WELLS AND SPRINGS IN PENNSYLVANIA, VOLUME III--DELAWARE RIVER BASIN,
Geological Survey, Harrisburg, PA. Water Resources Div.
For primary bibliographic entry see Field 7C.
W83-01185

GROUND-WATER QUALITY AND DATA ON WELLS AND SPRINGS IN PENNSYLVANIA, VOLUME II--SUSQUEHANNA AND POTOMAC RIVER BASINS,
Geological Survey, Harrisburg, PA. Water Resources Div.
For primary bibliographic entry see Field 7C.
W83-01186

SALINE GROUND-WATER DISCHARGE TO THE SMOKY HILL RIVER BETWEEN SALINA AND ABILENE, CENTRAL KANSAS,
Geological Survey, Lawrence, KS. Water Resources Div.
For primary bibliographic entry see Field 5G.
W83-01191

INTERPRETATION OF PH AND EH TRENDS IN A FLUVIAL-SAND AQUIFER SYSTEM,
Department of the Environment, Ottawa (Ontario). Inland Waters Directorate.
For primary bibliographic entry see Field 2K.
W83-01201

AN ALTERNATIVE CONCEPTUAL MODEL OF GROUNDWATER FLOW,
National Hydrology Research Inst., Ottawa (Ontario).
A. Vandenberg.
Journal of Hydrology, Vol 57, No 1/2, p 187-201, May, 1982. 5 Fig, 5 Ref.

Descriptors: *Model studies, *Groundwater movement, Finite difference methods, Numerical analysis, Probability, Markov processes, Finite element analysis, Kinetic gas theory.

A conceptual model of groundwater flow is developed, based on probability and a particulate description of interstitial water. This alternative approach borrows from basic concepts, especially the kinetic gas theory, Markov chains, and finite-difference techniques. Transmissivity, storativity, and Darcy's law are not introduced. Analytical and numerical methods are considered approximations, the first permitting direct calculation of a system state at any time and location and the second requiring calculation of the system state at all previous time steps and for all elemental compartments. The conceptual model seems to merge with the standard model of groundwater flow in the finite-difference approximation to the diffusion equation. It provides insight into the nature of the stability criterion for the explicit finite-difference technique. (Cassar-FRC)
W83-01204

HEAT STORAGE IN A SHALLOW CONFINED AQUIFER: GEOPHYSICAL TESTS TO DETECT THE RESULTING ANOMALY AND ITS EVOLUTION WITH TIME,
Centre National de la Reherche Scientifique, Pouilly sur Loire (France). Centre de Recherches Geophysiques.
Y. Benderitter, and J. Tabbagh.
Journal of Hydrology, Vol 56, No 1/2, p 85-98, March, 1982. 8 Fig, 9 Ref.

Descriptors: *Aquifers, *Injection, *Heat flow, *Confined aquifers, Resistivity, Heated water, Groundwater, Model studies, Shallow aquifers, *Electrical resistivity, *France, Bonnard.

The decrease in electrical resistivity of the ground surface was used to monitor heat produced by injections of 30-40 C water into a shallow confined aquifer situated between 4 and 7 m from the surface. Measurements were taken up to 30 m from the borehole during an 11 month period of six injection, storage, and pumping cycles. The heat anomaly decreased irregularly with distance from the borehole, with time during the storage period, and after pumping. Increases were observed with

every injection. The evolution of the anomaly with space and time is indicated on maps. A model was proposed to show the effect of hot water injection into the saturated zone of the aquifer and a secondary effect of thermal leakage through the borehole lining. This method permits on-site definition of the relationship between electrical resistivity and ground temperature. (Cassar-FRC)
W83-01205

SIMULATION OF LONG-TERM TRANSIENT DENSITY-DEPENDENT TRANSPORT IN GROUNDWATER,
Waterloo Univ. (Ontario). Dept. of Earth Sciences.
E. O. Frind.
Advances in Water Resources, Vol 5, No 2, p 73-88, June 1982. 12 Fig, 18 Ref.

Descriptors: *Groundwater movement, *Model studies, Density, Mathematical models, Confined aquifers, Aquifer characteristics, Finite element analysis, Optimization, Numerical analysis.

A numerical model for the economical simulation of long-term transient response in density-dependent transport problems is introduced. Although a classical Galerkin finite element approach is used, emphasis on optimum efficiency throughout the development results in a scheme that is significantly less costly than comparable existing schemes. Some distinctive aspects of the model include the elimination of static quantities in the fluid continuity equation, achieved by the introduction of the equivilent freshwater head; and the elimination of numerical integration, achieved by the deliberate choice of linear elements. Fluid velocities are discontinuous across the element boundaries. However, the solution obtained with discontinuous velocities approaches that obtained with continuous velocities as the grid is refined, and the two types of solutions give essentially the same results when the elements are in the same size range. The model is applied to simulate the complete transient response for a well-known problem of seawater intrusion in a confined aquifer. (Baker-FRC)
W83-01220

THE HYDROGEOLOGY OF ALLUVIAL AQUIFERS IN OR BORDERING THE DISSECTED TILL PLAINS,
Missouri Univ., Columbia. Dept. of Geology.
L. L. Gorday.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-139881, Price codes: A07 in paper copy, A01 in microfiche. M. A. Thesis, May 1982. 145 p, 40 Fig 7 Tab, 36 Ref, 2 Append. OWRT A-129-MO(3).

Descriptors: *Permeability coefficient, *Particle size, *Alluvial aquifers, *Geohydrology, *Groundwater movement, Missouri, Evapotranspiration, Alluvium, Pumping Tests, Till Plains.

The till plains area of northern Missouri currently has an inadequate supply of water, and the condition is expected to worsen as the demand for water grows. In this area, alluvial aquifers may be a low cost source for significant quantities of water. The two areas of direct investigation were the alluvial aquifers of Perche Creek and Goodwater Creek. The thickness of the alluvium at Goodwater Creek averaged 4.1 m, and the hydraulic conductivity of the alluvium was 6.1 x 10 to the minus 7 m/s. The yearly groundwater flow from the basin through the alluvium is 80.2 cu m/yr. A revised water budget for Goodwater Creek shows agreement with Hesemann's conclusions of a steady state system during years of average rainfall, and that evapotranspiration in the major source of discharge from the basin. In the area of the seismic line across Perche Creek the alluvium averages 17.7 m thick. The efficient grain size gives a closer relationship to the hydraulic conductivity of a sample than does either the effective grain size or the mean grain size. Pump tests indicate an average hydraulic conductivity of .000557 m/s for the Perche Creek alluvial aquifer. Preperly constructed wells in the Perche Creek alluvial aquifer could be expected to yield substantial quantities of water. The hydraulic conductivity and transmissivity of the alluvial aquiders in the region vary widely, even within local areas. Similarly the floodplain width, channel width, and depth to bedrock show great variation. (Moore-SRC)
W83-01269

NETWORK MODEL FOR OPTIMAL MANAGEMENT OF STREAM-AQUIFER SYSTEMS,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
For primary bibliographic entry see Field 4B.
W83-01366

STEADY NON-DARCY SEEPAGE THROUGH CONFINED AQUIFER OF VARIABLE THICKNESS,
Center for Water Resources Development and Management, Calicut (India).
P. Basak, and J. P. Soni.
Mausam, Vol 31, No 1, p 145-150, January, 1980. 4 Fig, 1 Tab, 24 Ref.

Descriptors: *Confined aquifers, *Seepage, *Flow characteristics, Linear flow, Darcys Law, Aquifers, Groundwater movement.

A steady state analytical solution for the case of a confined aquifer of variable thickness incorporating Forchheimer's non-linear velocity gradient response is presented. The solution is compared with the available solution for Darcian linear flow. The effect of non-linearity in the flow response on the discharge characteristics and the piezometric pressure distribution in relation to the corresponding linear case is brought out. (Baker-FRC)
W83-01378

2G. Water In Soils

STABILITY ANALYSIS OF WATER MOVEMENT IN UNSATURATED POROUS MATERIALS. I. THEORETICAL CONSIDERATIONS,
New South Wales Univ., Kensington (Australia). School of Civil Engineering.
G. A. Diment, K. K. Watson, and P. J. Blennerhassett.
Water Resources Research, Vol 18, No 4, p 1248-1254, August, 1982. 3 Fig, 1 Tab, 21 Ref.

Descriptors: *Groundwater movement, *Capillarity, *Model studies, *Stability analysis, Porosity, Soil water, Hydrodynamics, Mathematical studies, *Porous media, Mathematical equations.

An adequate stability analysis for flow in unsaturated porous materials was sought. The principles of hydrodynamic stability analysis are summarized and then used to develop a linear perturbation equation for vertical water movement with nonsharp fronts. A numerical approach for determining the stability parameters involving the eigenvalues of a matrix solution is outlined. The numerical results are checked against an analytical solution for a profile exhibiting a uniform distribution of capillary potential. The method as developed is general in its application and is able to be used in analyzing instabilities in systems exhibiting nonsharp fronts. Characteristics of the present method include the specification of the soil water data of the porous media, the minimizing of time effects by the introduction of a moving coordinate system, and the use of eigenvalues in the solution. (Baker-FRC)
W83-01200

THE INFLUENCE OF LOW-ANGLED TOPOGRAPHY ON HILLSLOPE SOIL-WATER CONVERGENCE AND STREAM DISCHARGE,
Bristol Univ. (England). Dept. of Geography.
M. G. Anderson, and P. E. Kneale.
Journal of Hydrology, Vol 57, No 1/2, p 65-80, May, 1982. 12 Fig, 1 Tab, 21 Ref.

Descriptors: *Soil water potential, *Topography, *Stream discharge, Hydrologic maps, Hill and spur topography, Shallow topography, Discharge, Storms, Slopes, Hydrographs, Bristol, *England, Convergence, Infiltration, Catchments, Subsurface drainage.

A significant spatial shift occurred in the focus of soil-water convergence on a 6 degree hill slope with relatively minor hollow and spur topography. An empirical investigation was undertaken in a 0.8 sq km catchment near Bristol, England, over a 3-year period. Weirs divided the channel into four subcatchments: straight 4 degree slope, spur and hollow 2-6 degree slope, straight 6-10 degree slope, and spur and hollow 6-10 degree slope. The contribution of each subcatchment to the hydrograph varied during a given storm as the focus of convergence (as shown by soil water potential isolines) shifted from the center of the hollow towards the downstream spur and back again to the center over a period of several days. The period required for the focus to shift back toward the center of the hollow was longer in larger storm events, up to 8 days, than in smaller events, 2 days. These variations may be attributed to antecedent conditions controlling the focus location. This study shows the necessity for more accurate topographic indices for the identification of hillslope partial area zones in shallow topography. (Cassar-FRC)
W83-01213

CHEMICAL INTERACTIONS BETWEEN FOREST SOILS AND ACIDIC PRECIPITATION DURING A DORMANT SEASON ON WILDCAT RUN WATERSHED IN SOUTHWESTERN PENNSYLVANIA,
Pennsylvania State Univ., University Park. Inst. for Research on Land and Water Resources.
For primary bibliographic entry see Field 2K.
W83-01236

CONSERVATION TILLAGE EFFECTS ON WATER CONSERVATION,
Kansas State Univ., Manhattan. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 3F.
W83-01240

THE SEPTIC TANK AS A WASTEWATER TREATMENT AND DISPOSAL FACILITY,
Massachusetts Univ., Amherst. Dept. of Plant and Soil Sciences.
For primary bibliographic entry see Field 5D.
W83-01241

A WEIGHING LYSIMETER FOR USE IN ISOLATED FIELD AREAS,
Science and Education Administration, Stoneville, MS.
L. G. Heatherly, B. L. McMichael, and L. H. Ginn.
Agronomy Journal, Vol. 72, No. 5, p 845-847, September-October, 1980. 2 Fig, 1 Tab, 11 Ref.

Descriptors: *Lysimeters, *Water loss, *Evapotranspiration, Cotton, Soybeans, Soil water, Field tests, Measuring instruments.

A weighing lysimeter, designed for field studies, requires no power source or constant maintenance. A 60 x 60 x 120 cm deep box hangs from a crane scale suspended from a tripod. The only necessary maintenance is periodic levelling of the suspended box by adjusting turnbuckles at each corner, necessary because the tripod legs settle differentially. Measurements of rainfall (in mm) by lysimeter and rain gage, respectively, during three periods in summer were: 13.4 and 13.8, 61.9 and 70.6, and 26.0 and 29.5. Soil water contents in lysimeters planted with soybeans were close to those of surrounding soil at the 30, 60, and 90 cm levels. Highest water losses were seen during the first 46 days of soybean growth and during the period following the first bloom in cotton. Total seasonal water losses were 54.8 cm from cotton lysimeters and 46.5 cm from soybean lysimeters, or 0.45 and 0.38 cm per day, respectively. (Cassar-FRC)
W83-01308

A FIELD TEST OF A CONCEPTUAL COMPUTER SIMULATION MODEL FOR PREDICTING WATER AND SALT DISTRIBUTION,
Winter Rainfall Region, Stellenbosch (South Africa).
J. H. Moolman, and D. J. Beukes.

Irrigation Science, Vol. 2, No. 1, p 33-47, 1980. 8 Fig, 6 Tab, 11 Ref.

Descriptors: *Model studies, *Soil moisture, *Salinity, Soil properties, Soil types, Flow, Chemical properties, Computers, Physical properties, Unsaturated flow, Flow.

The unsaturated flow and unsaturated chemistry submodels of a conceptual computer simulation model developed to predict water and salt behavior in soils were tested under field conditions. The comparison of results was done with data obtained from an irrigation trial with alfalfa over a four year period. The model simulated the actual physical and chemical processes taking place in the soil with a fair degree of accuracy. The predicted moisture contents compared reasonably well with observed data, especially in the soil layers between 480 and 1200 mm. The simulation of moisture distribution was more accurate for plots receiving a high irrigation frequency than for plots given a low irrigation frequency. On a depth-weighted-mean scale, the predicted salt concentration of the soil layers shallower than 1200 mm was within 11% of the observed data. However, when the salt content of the soil layers between 1200 and 1920 mm was taken into account, the percentage error increased to about 40%. The results indicate that this simulation model can be extremely useful in predicting the long and short term effects of irrigation water on the root zone of a soil. However, field data are always needed to calibrate the unsaturated flow model for specific soil types. (Baker-FRC)
W83-01309

A CONCEPTUAL MODEL OF WATER TRANSPORT THROUGH UNSATURATED SOIL ZONE,
Physical Research Lab., Ahmedabad (India).
P. S. Datta, S. K. Gupta, and S. C. Sharma.
Mausam, Vol 31, No 1, p 9-18, January, 1980. 10 Fig, 1 Tab, 12 Ref.

Descriptors: *Water transport, *Soil water, *Model studies, Mathematical studies, Unsaturated flow, *India, Indo-Gangetic plains.

A simple conceptual model of water transport in the unsaturated soil zone is presented. In the model the transport of water is visualized in pulses of infiltrating sheet through a series of interconnected expandable mixing cells. By applying the mass balance equation successively to each hypothetical mixing cell, sub-dividing the soil profile at discrete time intervals, the process of dispersion and mixing during transport of water through the zone is mathematically approximated. Simulation of tritium tracing experiments in Indo-Gangetic plains of north India using the above model closely reproduced field data. A close correlation was seen to exist between the rainfall and the estimated number of recharge pulses from the field data. (Baker-FRC)
W83-01376

2H. Lakes

THE PHYTOPLANKTON OF SOME FRESHWATER BODIES FROM ZULIA STATE (VENEZUELA),
Universidad Nacional del Zulia, Maracaibo (Venezuela).
S. Yacubson.
Nova Hedwigia, Vol 33, No 1-2, p 279-339, 1980. 193 Fig, 75 Ref.

Descriptors: *Algae, *Chlorophyta, *Cyanophyta, *Venezuela, *Surveys, *Lakes, *Taxonomy, *Hydrobiology, Phytoplankton, Desmids, Euglenophyta, Ponds, Species Composition, Classification, Inland waterways.

Studies were carried out on the phytoplankton of some inland waters of the western part of Zulia State, Venezuela. Algae were collected in fine Mesh silk nets from the Rio Limon drainage area between the Mara and Paez districts. Algae from many aquatic environments such as brooks, pools, and standing water bodies situated in the vicinities of the main biotopes were also examined. Of the 211 taxa described, 27 are Cyanophyta and 117 are Chlorophyta, of which 73 are Desmids and 67 are Euglenophyta. Sixteen of the taxa are reported as new to science, and 110 representing 7 genera are registered here for the first time in Venezuela. The descriptions are supplemented with diagrams and photomicrographs. (Geiger-FRC)
W83-01063

ALGAL GROWTH STIMULUS BY PHOSPHORUS IN FLATHEAD LAKE, MONTANA, SEDIMENTS,
Montana Univ., Flathead Lake. Biological Station.
For primary bibliographic entry see Field 5C.
W83-01065

SEDIMENTATION IN AN ARTIFICIAL LAKE - LAKE MATAHINA, BAY OF PLENTY,
Waikato Univ., Hamilton (New Zealand). Dept. of Earth Sciences.
For primary bibliographic entry see Field 2J.
W83-01084

LIMNOLOGY OF OPAL LAKE,
Scientific and Industrial Research, Taupo (New Zealand), Ecology Div.
D. J. Forsyth, and A. L. MacKenzie.
New Zealand Journal of Marine and Freshwater Research, Vol 15, No 3, p 279-283, 1981. 4 Tab, 14 Ref.

Descriptors: *Lakes, *Limnology, *Benthic environment, Benthos, Benthic fauna, Benthic flora, Aquatic life, Aquatic plants, Aquatic animals, Natural waters, Phytoplankton, Acidity, Macroinvertebrates, *New Zealand, Opal Lake, *Acidic Water.

Opal Lake is strongly acidic but with no apparent geothermal inputs. It occupies a hydrothermal explosion crater at the northern base of Maungakakaramea and has an area of 0.54 ha. It is about 140 meters long and 50 meters wide with a maximum depth of 5.5 meters, a mean depth of 3.3 meters and a catchment area of about 55 ha. Water was sampled in September of 1976 and in March and November of 1977. The biota of Opal Lake was limited in the number of taxa but not necessarily in abundance and was more typical of other acid lakes of the region. A greater phytoplankton species diversity was noted in Opal Lake than in neighboring Lake Rotokawa. Opal Lake supported submerged macrophytes, but the acidic water appeared to be limiting to some groups normally present in the fauna of lentic waters. The mean standing crop of 6240 benthic macroinvertebrates per square meter was greater than population densities given for local meso-eutrophic lakes. The macroinvertebrate population was comprised of more than 98% chironomid larvae represented by 4 species. Molluscs were absent. (Baker-FRC)
W83-01116

NUTRIENT ENRICHMENT OF SEAGRASS BEDS IN A RHODE ISLAND COASTAL LAGOON,
Rhode Island Univ., Kingston. Dept. of Botany.
For primary bibliographic entry see Field 5C.
W83-01129

SIMPLE TROPHIC STATE CLASSIFICATION OF THE CANADIAN NEARSHORE WATERS OF THE GREAT LAKES,
Canada Centre for Inland Water, Burlington (Ontario).
For primary bibliographic entry see Field 5C.
W83-01199

THE ESTABLISHMENT OF WATER QUALITY GRADIENTS IN RESERVOIRS,
Army Engineer Waterways Experiment Station, Vicksburg, MS.
For primary bibliographic entry see Field 5B.
W83-01222

PATTERNS OF CIRCULATION AND NUTRIENT SUPPLY IN A MEDIUM RESIDENCE-TIME RESERVOIR KOOTENAY LAKE, BRITISH COLUMBIA,
National Water Research Inst., Vancouver (British Columbia).
E. C. Carmack, and C. B. J. Gray.
Canadian Water Resources Journal, Vol 7, No 1, p 51-70, 1982. 7 Fig, 1 Tab, 14 Ref.

Descriptors: *Water circulation, *Nutrients, *Reservoirs, Kootenay Lake, *British Columbia, Canada, Lakes, Physical properties, Chemical properties, Rivers, Seasonal variations, Mixing, Wind, Overflow, Underflow.

Kootenay Lake, a long, deep lake in the Columbia River System, is a medium residence time system in which the physical and chemical characteristics are influenced by the two major rivers in the area. The interactive effects of three separate processes must be studied in order to understand seasonal circulation patterns. These processes are mixed-layer dynamics, internal wave behavior and the riverine circulation. Incoming river water may move laterally through the lake as a surface overflow, an intermediate depth interflow or a near-bottom underflow. Vertical redistribution of riverine water masses is dependent upon surface driven processes. The combined effect of both of the above processes may be altered still further by internal seiche motions, which can reposition various layers within the lake relative to the surface, where wind mixing is more intense. Construction of dams on both upstream rivers has led to changes in the timing and temperature of discharge to the lake. To predict the effects of alterations in riverine nutrient loadings on the primary producers, the nutrient supply of phosphorus and nitrogen was compartmentalized on the basis of physical processes controlling distribution during various times of the year. The compartments were the epilimnion starting load, river inputs during summer growing season and inputs from entrainment of metalimnetic water during autumnal cooling. (Baker-FRC)
W83-01223

PHYTOPLANKTON COMPOSITION AND DISTRIBUTION AS AN EXPRESSION OF PROPERTIES OF RESERVOIRS,
Barcelona Univ. (Spain). Dept. of Ecologia.
R. Margalef, M. Mir, and M. Estrada.
Canadian Water Resources Journal, Vol 7, No 1, p 26-50, 1982. 6 Fig, 4 Tab, 11 Ref.

Descriptors: *Reservoirs, *Water quality, *Monitoring, *Phytoplankton, Sedimentation, Sediments, Aquatic plants, Chemical properties, Water analysis, *Spain, Physical properties, *Bioindicators.

Counts were made of some 335 sedimented samples of phytoplankton collected in 91 Spanish reservoirs. More than 250 species were recognized. A principal component analysis was performed on the correlation matrix of the log-transformed densities of 41 species or groups of species. The second component is related to mineralization, the third component to the fertility of water, and the fourth to the degree of stratification. The major purpose of the study was to determine whether phytoplankton data could reveal the structure of the piece of nature under description and consideration. The ultimate value of phytoplankton communities as indicators of water quality depends on the reliability with which identification can be made of some principal directions of variability in relationship with factors or complexes of factors of the environment. The convergence in the results of the different approaches that have been proposed and applied to non-coincident samplings in Spanish reservoirs seems to support the soundness of the approach. Chemical parameters may be easier to measure for the purpose of monitoring, but phytoplankton composition may offer very useful complementary indications. (Baker-FRC)
W83-01224

WATER RENEWAL EFFECTS ON RESERVOIR ZOOPLANKTON COMMUNITIES,
Oklahoma Univ., Kingston. Biological Station.
S. T. Threlkeld.

Canadian Water Resources Journal, Vol 7, No 1, p 151-167, 1982. 5 Fig, 2 Tab, 31 Ref.

Descriptors: *Reservoirs, *Zooplankton, *Water quality, Dilution, Limnology, Light penetration, Temperature effects, Texas, Oklahoma, Tennessee, Arkansas, Montana, Cladocerans.

Water renewal may influence reservoir zooplankton communities through the mechanisms of dilution or transport or through localized modifications of limnological conditions which then provide the setting for alteration of zooplankton community structure. An inverse relationship was noted between reproduction in cladoceran zooplankton and water renewal time for six reservoirs sampled during the summer of 1980. This relationship suggests a strategic response in renewal. However, analysis of variation in cladoceran demography at different sites within each of the reservoirs and over a four month period at a single site in one reservoir demonstrated that reproductive variation could be explained by spatial or temporal variation in limnological conditions and independent of transport or dilution processes associated with water renewal. (Baker-FRC)
W83-01226

MATHEMATICAL MODEL FOR DISSOLVED OXYGEN IN THREE SOUTHERN ONTARIO RESERVOIRS,
Johns Hopkins Univ., Baltimore, MD. Dept. of Geography and Environmental Engineering.
For primary bibliographic entry see Field 5B.
W83-01227

SPATIAL VARIATIONS IN ABUNDANCE OF PHYTOPLANKTON, ZOOPLANKTON, AND LARVAL FISHES IN CENTER HILL RESERVOIR,
Georgia Univ., Athens.
M. J. Van Den Avyle, R. S. Hayward, R. A. Krause, and A. J. Spells.
Canadian Water Resources Journal, Vol. 7, No. 1, p 189-214, 1982. 8 Fig, 8 Tab, 12 Ref.

Descriptors: *Aquatic life, *Spatial distribution, *Reservoirs, Zooplankton, Phytoplankton, Population dynamics, Fish, Center Hill Reservoir, *Tennessee, Lakes, Seasonal variation.

Densitites of phytoplankton, zooplankton, and larval fishes in Center Hill Reservoir, Tennessee, were determined to evaluate differences in abundance between embayments and mainstream areas and to assess longitudinal gradients in the reservoir. Plankton were collected monthly from May 1978 through June 1979, and larval fishes were collected biweekly from May through August 1978 at five mainstream and five embayment sites established along the reservoir. Statistical analyses for the majority of plankton and larval fishes indicated that spatial variations in abundance were primarily related to localized environmental conditions rather than the hydraulic gradient of the reservoir. Most taxa were more abundant in embayments than in nearby mainstream sites, and although abundance usually varied significantly among the five mainstream stations, densities showed no consistent gradient in the upstream-downstream dimension of the reservoir. Abundance of phytoplankton and rotifers was more uniform at the mainstream stations during periods of low inflow and high water temperature. Copepod and cladoceran densities, however, were more uniform during periods of high inflow. The existence of spatial variations in biological communities should be recognized when assessing trohic status or developing predictive models of reservoir systems. (Baker-FRC)
W83-01230

LAKE ERIE OXYGEN; THE PREHISTORIC RECORD,
National Water Research Inst., Burlington (Ontario).
L. D. Delorme.
Canadian Journal of Fisheries and Aquatic Sciences, Vol. 39, No. 7, p 1021-1029, July, 1982. 6 Fig, 8 Tab, 19 Ref.

Descriptors: *Lakes, *Eutrophication, *Anoxia, Periodic anoxia, Ostracods, Inorganic carbon, Organic carbon, Carbon, *Lake Erie, Great Lakes, Oxygen, Dissolved oxygen.

In the central basin of Lake Erie, periodic anoxia as a symptom of eutrophication has lasted for hundreds or thousands of years. Fossil ostracod remains in sediment cores show that a common species, Candona caudata, has survived in spite of periodic anoxia due to its tolerance to low dissolved oxygen and a short life cycle of weeks to several months. These qualities have enabled it to survive at levels below 2.3 mg/liter. Two species expected to be found but not found were Candona subtriangulata and Cytherissa lacustris. These could not cope with the periodic low oxygen levels. This condition appears to have been common in the lower part of some of the sediment cores examined. A time-transgressive change in carbon concentration occurred in the surficial sediments of the central basin. A decrease in carbon started in the Sandusky basin around 4000 yr ago and gradually extended itself to the middle of the central basin by 1220 A.D. The loss of carbonate in the upper part of the sediment profile probably resulted from trapping of carbon dioxide, produced by the decomposition of organic material by oxidation and bacterial activity in the hypoilimnion. (Baker-FRC)
W83-01231

USE AND LIMITATIONS OF SEDIMENTARY PIGMENTS AS INDICATORS OF PAST LAKE PRODUCTIVITY,
Massachusetts Univ., Amherst. Dept. of Zoology.
For primary bibliographic entry see Field 5A.
W83-01237

210PB GEOCHRONOLOGY AND TRACE METAL CONCENTRATIONS OF SEDIMENTS FROM UPPER KLAMATH LAKE AND LAKE EUWANA, OREGON,
Geological Survey, Corpus Christi, TX.
For primary bibliographic entry see Field 2J.
W83-01252

BACTERIAL ENRICHMENTS IN SURFACE FILMS OF FRESHWATER LAKES,
Minnesota Univ., Navarre. Gray Freshwater Biological Inst.
R. L. Crawford, L. Johnson, and M. Martinson.
Journal of Great Lakes Research, Vol 8, No 2, p 323-325, 1982. 1 Fig, 2 Tab, 9 Ref.

Descriptors: *Bacteria, *Trophic level, *Air-water interfaces, Lakes, Surface film, *Lake Superior, Oligotrophic lakes, Eutrophic lakes, Transparency, Enrichment, Films.

Some highly transparent lakes showed small enrichments of total bacteria or benzoic-acid-degrading bacteria in the 10-100 micron thick surface layer as compared with subsurface water (0.1 m depth). More eutrophic lakes did not show significant enrichment of bacteria in the surface film. A relationship was developed between Secchi disc depth (1-10 m) and enrichment factor (8 to 24) for a series of lakes. In midsummer bacterial numbers in Lake Superior (highly transparent) were 1.1 billion per ml in the surface film and 47 million per ml in the subsurface layer; in Lake Independence (Secchi depth 1 m), 280 million per ml in the surface film and 29 million per ml in the subsurface layer. (Cassar-FRC)
W83-01261

FRACTIONATION OF HYDROPHOBIC ORIGIN MATERIALS IN SURFACE MICROLAYERS,
Michigan Univ., Ann Arbor. Dept. of Atmospheric and Oceanic Science.
For primary bibliographic entry see Field 5B.
W83-01266

MODELS OF PARTICLE DRY DEPOSITION TO A LAKE SURFACE AND SOME EFFECTS OF SURFACE MICROLAYERS,
Illinois Univ. at the Medical Center, Chicago. School of Public Health.
For primary bibliographic entry see Field 5B.
W83-01267

LIMNOLOGY OF MT. ELBERT FOREBAY 1978-79,
Bureau of Reclamation, Denver, CO. Engineering and Research Center.
J. R. Boehmke, J. F. LaBounty, J. J. Sartoris, and R. A. Roline.
Report REC-ERC-82-6, March 1982. 25 p, 15 Fig, 11 Tab, 8 Ref, 1 Append.

Descriptors: *Limnmology, *Reservoirs, *Pumped storage, *Plankton, *Benthos, Nitrogen compounds, Phosphorus compounds, Iron, Zinc, Thermal strtification, Environmental effects, Dissolved solids, Colorado.

The forebay for Mt. Elbert Pumped-Storage Powerplant is located about 137 m above Twin Lakes, Colorado. Prior to the forebay construction, the area consisted of sagebrush, sandy soil, and stands of aspen. The constructed bottom was a 1.5-m thick compacted sandy-silt liner; however, in the fall of 1980, a chlorinated polyethylene (CPE) liner was added to decrease seepage. In 1977-78, the forebay was filled to 19% capacity with water pumped from Twin Lakes. Throughout the duration of the limnological study (November 1978-September 1979), the forebay had neither an inlet nor an outlet. It was found to be a cold monomictic impoundment. The forebay was higher in dissolved substances, and nitrogen and phosphorus compounds, but lower in abundance of plankton and benthic organisms than the afterbay. A possible cause of lesser abundance of organisms is higher concentrations of iron and zinc that were found in the forebay. This study provides baseline data to help determine environmental effects of the CPE liner. Limnological studies will be continued on the forebay and Twin Lakes to determine ecological effects of pumped storage. (Moore-SRC)
W83-01268

THE INFLUENCE OF ALGAL GROWTH AND OTHER ECOLOGICAL FACTORS IN RESERVOIRS ON THE PRODUCTION AND CONTROL OF TRIHALOMETHANE PRECURSORS,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5F.
W83-01279

FRESHWATER RED ALGAE A NEW ADDITION TO THE IRAQI FLORA,
Sulaimaniyah Univ. (Iraq). Dept. of Biology.
G. C. F. Hinton, and B. K. Maulood.
Nova Hedwigia, Vol. 33, No. 1-2, p 487-497, 1980. 4 Fig, 16 Ref.

Descriptors: *Hydrobiology, *Algae, *Iraq, *Taxonomy, *Aquatic habitats, *Rhodophyta, Phytoplankton, Species composition, Aquatic life, Species diversity, Habitats, Deep-water habitats, Audouinella violacea.

The distribution of five previously unrecorded red algal genera in Iraq was recorded in studies that sampled most types of aquatic habitats of the country. Of the 50 sites investigated only ten sites contained freshwater red algae. Audouinella violacea was the most widely distributed taxon in the mountainous region in Iraqi Kurdistan. Compopogon, a common genus of warmer waters, was found at only two of the sites investigated in Iraq. Thorea was very rare; its appearance was transitory in early summer and confined to swiftly flowing waters. The lack of shaded habitats in the hot Iraqi summers probably accounts for the scarcity of Batrachospermum which was found at only three sites. Hildenbrandia was also restricted in its occurrence, being found only in a waterfall and a deep area of an isothermal spring. (Geiger-FRC)
W83-01322

DENSITY-DRIVEN INTERSTITIAL WATER MOTION IN SEDIMENTS,

Alaska Univ., Fairbanks. Inst. of Marine Science.
D. L. Musgrave, and W. S. Reeburgh.
Nature (London), Vol 299, No 5881, p 331-334, September, 1982. 1 Fig, 20 Ref.

Descriptors: *Bottom currents, *Interstitial water, *Sediments, Bottom sediments, Sediment transport, Rayleigh number, Nusselt number, Mixing, Lakes, *Ontario, Experimental Lakes Area.

Temperature-time series measurements for a freshwater lake undergoing autumn cooling were examined. These are the first in situ observations of heat transport due to motion of interstitial waters over periods of less than 1 hour. Density, calculated from temperature, decreased with depth at the time and place that this motion occurred. Three probes were placed in the sediments of Lake 227 of the Experimental Lakes Area, Ontario, Canada, at water depths of 0.75, 1.25, and 1.75 m. These sediments have high, nearly constant porosity (0.85) and organic content. The probes were in place from mid to late October 1979 in anticipation of bottom-water density increases due to autumn cooling. It is suggested that the convecting layer, beneath a shallow stable layer, caused the observed fluctuations in some manner whose details have been examined theoretically. The increase in heat transport due to convection is quantified by the Nusselt number, which is the ratio of heat flux across a convecting layer to the heat flux across the same layer, assuming purely diffusive transport. Near the critical Rayleigh number the Nusselt number is just above 1. In Lake 227 the Rayleigh number continues to grow with time until the convecting layer intersects the impermeable rock below the sediments at 10 m. (Baker-FRC)
W83-01372

HIGH ABUNDANCE OF ALGAL 24-ETHYLCHOLESTEROL IN ANTARCTIC LAKE SEDIMENT,
Tokyo Metropolitan Univ. (Japan). Dept. of Chemistry.
G. Matsumoto, T. Torii, and T. Hanya.
Nature (London), Vol 299, No 5877, p 52-54, September, 1982. 1 Fig, 1 Tab, 35 Ref.

Descriptors: *Lake sediments, *Polar regions, *Sterols, Chemical analysis, Bottom sediments, *Antarctica, Algae, Cyanophyta, Chlorophyta, Phormidium.

The first analyses of sterols in Antarctic lake sediments are reported. These sediments were found to contain high abundances of 24-ethylcholesterol. This was the most prominent sterol in some soils and water samples from the dry valley areas as well. There are at least three possible sources for these unusual distributions of sterols: an input of aeolian dust, glacial erosion of sedimentary rocks, or biological sources such as bacteria, fungi, blue-green and green algae, and mosses found in the areas. Analytical studies revealed that 24-ethylcholesterol is the major sterol in epibenthic algae which are widely distributed in the area. Therefore algae, including green and blue-green algae, especially Phormidium spp., are important sources of 24-ethylcholesterol in Antarctic dry valley lake sediments. (Baker-FRC)
W83-01373

2I. Water In Plants

RESPONSES TO WATER STRESS IN WHEAT AND RELATED WILD SPECIES,
Agricultural Research Organization, Bet-Dagan (Israel). Inst. of Soils and Water.
For primary bibliographic entry see Field 3F.
W83-01145

EFFECTS OF ARTIFICIAL CONIFER FOLIAGE ON COLLECTION OF PRECIPITATION AND NUTRIENTS IN COASTAL BRITISH COLUMBIA,
Toronto Univ. (Ontario). Dept. of Botany.
J. B. DeCatanzaro, and D. Binkley.
Canadian Journal of Forest Research, Vol 11, No 2, p 457-458, 1981. 1 Tab, 5 Ref.

Descriptors: *Nutrients, *Moisture density, *Forests, *British Columbia, Canada, Cycling nutrients, Ecosystems, Condensation, Precipitation, Calcium, Potassium, Ammonium, Nitrate, Sulfate, Impaction, Aerosols, Augmentation.

The occurrence of moisture condensation and aerosol impaction in coastal British Columbia forests was investigated using artificial Douglas-fir foliage. Differences in these phenomena related to elevation were also sought. The presence of artificial foliage significantly increased both water and nutrient collections. Elevation accounted for significant differences in volume only. The presence of artificial foliage increased water volumes by 6% on the upper and 8% on the lower sites. The increase in nutrient content in collectors under artificial foliage varied from 23 to 143%. (Baker-FRC)
W83-01218

CANOPY AIR TEMPERATURES AND EVAPOTRANSPIRATION FROM IRRIGATED AND STRESSED SOYBEANS,
Science and Education Administration, Morris, MN.
For primary bibliographic entry see Field 2D.
W83-01313

IRRIGATION FOR CROPS IN A SUB-HUMID ENVIRONMENT, II. THE WATER REQUIREMENTS OF SOYBEANS,
University of New England, Armidale (Australia). Dept. of Agronomy and Soil Science.
W. K. Mason, G. A. Constable, and R. C. G. Smith.
Irrigation Science, Vol. 2, No. 1, p 13-22, 1980. 5 Fig, 2 Tab, 18 Ref.

Descriptors: *Irrigation patterns, *Crop production, *Water requirements, Irrigation requirements, Crop yield, *Soybeans, Farming, Evaporation, Soil water, Water supply.

An understanding of soybean water requirements and patterns of soil water extraction was sought. The water use of two soybeans cultivate (Bragg and Ruse) was measured over three seasons for a range of irrigation treatments. The seasonal totals of plant and soil evaporation ranged from 450 to 750 mm or from 36 to 64% of class A pan evaporation for the same period. Both cultivars extracted approximately 60% of the total extractable soil water in the top 1.2 m of soil before actual evaporation dropped below potential evaporation. Up to this point the ratio between the actual evaporation and class A pan evaporation averaged 0.8. Ruse used water at a faster rate than Bragg, but Ruse was not as effective in extracting the deep (below 1.0 m) soil water as was Bragg. Water use efficiency showed a small but general increase with decreasing irrigation water application. Runoff losses varied from zero for non-irrigated Ruse in 1977/78 to 352 mm for frequently irrigated Bragg in 1976/77, generally with the number of irrigations. (Baker-FRC)
W83-01314

2J. Erosion and Sedimentation

STOCHASTIC PREDICTIONS OF SEDIMENT YIELDS FROM SMALL COASTAL WATERSHEDS IN OREGON, U.S.A.,
Oregon State Univ., Corvallis. Dept. of Electrical and Computer Engineering.
J. VanSickle.
Journal of Hydrology, Vol 56, No 2/4, p 309-323, April, 1982. 4 Fig, 3 Tab, 23 Ref.

Descriptors: *Sediment yield, *Stochastic process, Runoff, *Small watersheds, Watersheds, Model studies, *Oregon, *Sediment transport, Suspended sediments.

A simple stochastic model of sediment yield is applied to data from two small Oregon coast range watersheds, Flynn Creek and Needle Branch. In this region nearly all sediment is transported during brief, distinct runoff events, especially in watersheds impacted by logging. To generate sequences of sediment yield events the model combines a runoff event frequency analysis, an event-generating process, and an empirical relationship between sediment yield and discharge. Annual sediment yields are obtained by adding the yields from individual events. The observed annual yields appear to be less variable than predicted from random sums of individual storm event yields. These discrepancies are likely a result of controls by sediment sources not included in the model. During dry years sediment accumulated in channels, and small runoff events carried greater-than-predicted loads. In years with larger runoff events observed yields were less than predicted because of flushing during the first large event. The model used here can successfully synthesize reliable long-term sediment yield distributions as long as several years of sediment data are available and sediment supplies and yields are relatively stationary. (Cassar-FRC)
W83-01053

SEDIMENTATION IN AN ARTIFICIAL LAKE - LAKE MATAHINA, BAY OF PLENTY,
Waikato Univ., Hamilton (New Zealand). Dept. of Earth Sciences.
C. J. Phillips, and C. S. Nelson.
New Zealand Journal of Marine and Freshwater Research, Vol 15, No 4, p 459-473, 1981. 13 Fig, 2 Tab, 27 Ref.

Descriptors: *Sedimentation, *Lakes, Lake Matahina, Artificial lakes, Sediment, *Lake sediments, Bottom sediments, Fluvial sediments, Catchments, Basins, *New Zealand.

Lake Matahina is a gorge-type reservoir with a maximum depth of 50 meters, a relative depth of 2.8%, and an annually fluctuating water level of only 0.5-0.75 meters. Upper reaches of the lake are shallow with a sinuous channel constricted by a narrow ignimbrite gorge. The lake appears to be a warm monomictic lake. The lake stratifies in summer and although a winter profile was not obtained, it is likely that it overturns and becomes homothermous for at least part of this season. The texture and composition of surficial and sub-bottom sediments reflect the interactions between supply of sediment from 2 major source lithologies - greywackes in the east and, more importantly, acid volcanics of both flow (ignimbrites) and particularly air-fall (tephras) origin in the west - and the influence of the inflowing Rangitaiki River upon water circulation and sediment dispersion within the lake. Three major proximal to distal lacustrine subenvironments occur: fluvial, deltaic, and basinal. Fluvial sediments occur in the upper reaches of the lake in depths of less than 3 meters and are lithic dominated, gravel-sand mixtures deposited from bed load in ephemeral channel and bar deposits. Deltaic sediments accumulate where the lake suddenly deepens from 3 to 20 meters. Basinal sediments occur deeper than 20 meters and are glassy-argillaceous silt-clay mixtures fed mainly by river plume dispersion of suspended sediment in overflows, interflows, and underflows. Sedimentation rates at the dam are about 2 cm/year. Fine sand layers in muds of basinal cores are probably deposited from density or underflow currents generated during river flooding, flowing the length of the lake. (Baker-FRC)
W83-01084

DYNAMICS OF THE FORESHORE OF A LARGE AGGRADATIONAL FEATURE IN THE NORTHWESTERN BLACK SEA,
Kiev State Univ. (USSR). Inst. of Fluid Mechanics.
V. V. Khomitskii, Yu. N. Sokol'nikov, A. V. Kalinovskii, and E. S. Tsaitts.
Water Resources, Vol 8, No 5, p 498-503, September-October, 1981. 3 Fig, 4 Ref. Translated from Vodnye Resursy, No 5, p 63-70, September-October, 1981.

Descriptors: *Spatial distribution, *Sediment transport, Estuaries, *Shores, *Aggradation, Dynamics, Morphology, *Sediment load, *Lithologic logs, Water management, Coasts, Sedimentation, Bathymetry, Erosion, Sediment distribution, *Black Sea.

To solve problems of assessing the spatial development of aggradational features and predicting possible changes in the natural regime of sediment movement for the construction of water management structures, an on-site investigation of the morpho- and lithodynamics of the body of the aggradational features should be organized. As an example of such a study, a bathymetric survey was carried out annually at the sounding sites for the seaside perimeter of the Kinburn spit to the 6.0-meter isobath and within the 4.0-meter isobath. More frequent soundings were taken at certain sections in 1976. Sediment load was calculated by the wind-wave energy method, and the longshore transport of sediments was calculated for five sections of the sea and liman perimeters of the Kinburn spit with uniform shoreline directions. Results showed that the transformation of the shore of the spit is closely related to the amount and direction of the longshore movement of sediments. Deformations of the contour of the spit on the liman side occurred analogously to the distribution of the sediment load. In the case of the Dnepr-Bug liman, the spit has stable configurations on the liman side, and the sea perimeter has shore deformations occurring in a cyclic character when the changes of the waterline on the profiles have an alternating character and the absolute value of recession is no more than 0.5 meters/yr. (Geiger-FRC)
W83-01095

AN IMPROVED METHOD OF DETERMINING SEDIMENTATION RATES BY THE USE OF ARTIFICIAL RADIONUCLIDES,
Lancaster Univ., Bailrigg (England). Dept. of Environment Sciences.
D. A. Stanners, and S. R. Aston.
Estuarine, Coastal and Shelf Science, Vol 13, No 1, p 101-106, July, 1981. 3 Fig, 5 Ref.

Descriptors: *Sedimentation rates, *Estuaries, *Regression analysis, Ravenglass Estuary, *England, Mathematical studies, Sediments, Estuarine environment, Sedimentation, *Radionuclides, Irish Sea, Spectroscopy.

The use of radionuclide activity profiles to determine estuarine sedimentation rates has been improved by the application of statistical tests. Sediment cores were taken by inserting polyethylene core liners directly into intertidal deposits. The cores were extruded, segmented, and the subsamples dried at 60 C. The radionuclide activities in the sediments were determined by gamma spectroscopy. A method is outlined for the use of regression analysis and test of best fit for applying nuclear waste discharge data to the quantitative determination of net sedimentation rates. The methodology also allows the measurement of apparent diffusion of radionuclides in sediments and the lag time from discharge point to sediment deposition. The technique was applied to sediment cores from the Ravenglass estuary near the Windscale, England, nuclear fuel reprocessing facility. The range of sedimentation rates was 0.25 to 71 mm per year, with a lag time of 1.5 year for radiocesium. (Baker-FRC)
W83-01153

DYNAMICS OF MUD (SLICK) AND SUSPENDED MATTER IN ESTUARIES. APPLICABILITY OF BY-PRODUCTS OF SURVEYS OF GERMAN COASTAL AGENCIES IN VIEW OF REQUIREMENTS FOR FUTURE NEEDS,
Deutsches Hydrographisches Inst., Hamburg (Germany, F.R.).
J. Hulsemann.
Deutsche Hydrographische Zeitschrift, Vol 35, No 2, p 82-89, 1982. 44 Ref.

Descriptors: *Dredging, *Suspended sediments, *Mud, *Sedimentation, *Estuaries, *Reviews, Sediment transport, *Germany, Fluid flow, Water circulation, Turbidity, Research priorities.

The state of the art of transport and sedimentation of fine-grained sediments as applied to the problem of dredging estuarine mud in Germany is summarized. Present sediment transport data are insufficient for use in management of navigation channels in estuaries because there is a wide discrepancy between theoretical and observed conditions. However, the water circulation in estuaries is reasonable well understood. A turbidity maximum occurs at the landwardly inclined sald water wedge. At this point sedimentation is increased. In German estuaries maintained by dredging, bed material the brackish water zone is characterized by sand and salt, whereas the fine-grained fraction collects at the side and banks of the channels. These fine sediments often lead to mud deposits in side arms of rivers, inner reaches of river bends, and harbors with mouths of branches. Some recent investigations revealed the existence of a fluid mud layer (70 g per liter suspended matter) near the bottom of the turbidity maximum region in the Weser Estuary. This relatively immobile layer is associated with spring and neap tides in high energy estuaries and with storms and dreding activities in low energy estuaries. The fluid mud layer erodes at the surface before the entire layer moves and is affected by shallow water waves. (Cassar-FRC)
W83-01161

EROSION, REDEPOSITION, AND DELIVERY OF SEDIMENT TO MIDWESTERN STREAMS,
Arizona Univ., Tucson. School of Renewable Natural Resources.
For primary bibliographic entry see Field 4D.
W83-01203

THE DYNAMICS OF A RIVER BEND: A STUDY IN FLOW AND SEDIMENTARY PROCESSES,
State Univ. of New York at Binghamton. Dept. of Geological Sciences.
For primary bibliographic entry see Field 2E.
W83-01249

210PB GEOCHRONOLOGY AND TRACE METAL CONCENTRATIONS OF SEDIMENTS FROM UPPER KLAMATH LAKE AND LAKE EUWANA, OREGON,
Geological Survey, Corpus Christi, TX.
E. A. Martin, and C. A. Rice.
Northwest Science, Vol 55, No 4, p 269-280, November, 1981. 2 Fig, 2 Tab, 34 Ref.

Descriptors: *Lake sediments, *Sedimentation rates, *Bottom sediments, Lakes, Sediments, Metals, Copper, Cadmium, Chromium, Iron, Lead, Manganese, Zinc, Mixing, Upper Klamath Lake, Lake Euwana, *Oregon.

In response to citizen complaints of sediment deposition, rates of sedimentation were calculated from the analyses of 210Pb activities in cores from two shallow lakes whose mean depths are 2.4 m, Upper Klamath Lake and Lake Euwana in Oregon. The studies indicated that the lakes are filling at approximately 3.0 mm/year. Average sedimentation rates for compaction-corrected cores range from 0.9 mm/year to 8.5 mm/yr or from 0.03 g/sq cm/yr to 0.48 g/sq cm/yr, respectively. Plots of excess 210Pb activity versus depth show a mixing layer due to biological activity and other physical mixing that ranges in thickness from 5 to 20 cm and that is found below the sediment-water interface at all coring locations. Trace metal analyses performed to establish baseline levels of selected elements show very low concentrations of all metals measured in cores from Upper Klamath Lake when compared with concentrations of these metals found in other North American lacustrine environments. The sediments from the lakes, except for a few pumice layers, are relatively homogeneous in texture and in moisture content, 81-92%. (Baker-FRC)
W83-01252

SEDIMENT FANS AND SEDIMENT FLOWS GENERATED BY SNOWMELT: OBSERVATIONS AT AUSTERDALSISEN, NORWAY,
Victoria Univ. of Manchester (England). Dept. of Geography.
W. H. Theakstone.
Journal of Geology, Vol, 90, No 5, p 583--588, 1982. 3 fig, 1 Tab, 22 Ref.

Descriptors: *Sediments, *Alluvial fans, *Snowmelt, Sedimentary structures, Fluvial sediments, Sediment transport, *Norway, Austerdalsisen, Erosion, Viscosity, Sands, Fluid mechanics, Hydrodynamics.

Sediments in the Austerdalsisen basin, Norway, are re-worked annually during the short snowmelt period. In the last 10-15 years several fans have been constructed, largely by sediment flows. Sediment-water mixtures move downslope under the influence of gravity. The viscosity of the flows varies considerably, and a single flow may change as a result of water or sediment loss. Fan characteristics reflect the nature of the sediments, the mechanics of flow, modes of deposition, and the annual periodicity of activity. The composition of most fans is dominated by grains of sand-size, which made up the bulk of the original succession in the Austerdalsisen basin. (Baker-FRC)
W83-01254

2K. Chemical Processes

GEOCHEMICAL DENUDATION RATES AND SOLUTE TRANSPORT MECHANISMS IN A MARITIME TEMPERATE GLACIER BASIN,
Toronto Univ. (Ontario). Dept. of Geology.
For primary bibliographic entry see Field 2C.
W83-01109

FLUID-MINERAL EQUILIBRIA IN A HYDROTHERMAL SYSTEM, ROOSEVELT HOT SPRINGS, UTAH,
Utah Univ. Research Inst., Salt Lake City. Earth Science Lab.
R. M. Capuano, and D. R. Cole.
Geochimica et Cosmochimica Acta, Vol 46, No 8, p 1353-1364, August, 1982. 7 Fig, 5 Tab, 53 Ref.

Descriptors: *Geothermal studies, *Equilibrium, *Mineral springs, *Hot springs, Springs, Wells, Chemical composition, Chemical reactions, Roosevelt Hot Springs, *Utah, Groundwater reservoirs.

An investigation of fluids and drill cuttings from the Roosevelt Hot Springs hydrothermal system, Utah, indicated a common reservoir source (temperature 288 + or - 10 C) for the four types of water present: deep circulating thermal fluid from producing wells, hot water from nonproducing wells, recent discharge from the Roosevelt seep, and water from the now dry Roosevelt Hot Spring. The deep fluid was sodium chloride in character, with 9700 ppm dissolved solids, pH of 6.0 , and gas partial pressures (in atmospheres) of oxygen ranging from 10 to the minus 32nd power to 10 to the minus 35th power; carbon dioxide, 11; hydrogen sulfide, 0.020; and methane, 0.001. Water from producing wells was distinctly different from water in nonproducing wells. Nonproducing wells had lower temperatures and concentrations of Na, K, F, Cl, and total dissolved solids and higher concentrations of Ca, Mg, Fe, sulfate, and bicarbonate. Minerals theoretically in equilibrium with the deep reservoir fluid at > 240 C were sericite, K-feldspar, quartz, chalcedony, hematite, magnetite, and pyrite. This group was similar to that in equilibrium in deep parts of producing wells. Epidote, anhydrite, chlorite, and calcite were not in equilibrium with the reservoir fluid. Results suggest that the reservoir fluid at Roosevelt Hot Springs has not significantly changed in the recent past. (Cassar-FRC)
W83-01142

CHEMICAL OSMOSIS, REVERSE CHEMICAL OSMOSIS, AND THE ORIGIN OF SUBSURFACE BRINES,
Illinois Univ. at Urbana Champaign. Dept. of Geology.
D. L. Graf.
Geochimica et Cosmochimica Acta, Vol. 46, No. 8, p 1431-1440, August, 1982. 6 Fig, 149 Ref.

Descriptors: *Osmotic pressure, *Brines, *Geochemistry, *Reverse osmosis, *Osmosis, *Chemical osmosis, Overpressuring, Aquathermal pressuring, Shales, Membrane processes, Sedimentary basins,

Seawater, Minerals, Tectonics, Deposition, Dissolved solids, Ion exchange, Geothermal studies, Diagenesis, Saline water, Chlorides, Sulfates, Calcium, Magnesium, Chemical precipitation, Chemical reactions, Hydrostatic pressure, Geologic fractures, Geohydrology, Pore pressure, Recharge, Gypsum, Dehydration.

Calculations using density and osmotic coefficients for NaCl-H2O indicate that overpressuring can overcome chemical osmosis and produce reverse chemical osmosis in sedimentary sequences. The most common mechanism for generating overpressuring is rapid deposition of fine-grained minerals. Other mechanisms are dehydration of gypsum (for brief periods at shallow depths), water evolation from conversion of smectite to illite (at greater depths), and tectonic compression and aquathermal pressuring (in sediment layers older than Cretaceous). Aquathermal pressuring may be of major importance in geothermal areas where low permeability seals block normal heat flow and of significant importance in areas with normal geothermal gradients where shales inhibit normal fluid flow. Evidence for membrane concentration of seawater solutes to form present-day brines includes: (1) the correlation of delta- D values of water molecules or pore fluid with those of local meteoric water, and (2) the need for major sources of Mg(++) and chloride in apparently evaporite-free basins. Where dissolution of halite is a major source of dissolved solids, reverse chemical osmosis operates to leak relatively dilute solutions from overpressured regions. Concentrated chloride brines rich in Ca(++) are effectively produced by reactin of Mg(++) with limestone to form dolomite. This reaction decreases Mg(++) concentrations, increases Ca(++) concentrations, and decreases sulfate and carbonate by precipitation of CaCO3 and CaSO4. (Cassar-FRC)
W83-01143

STATISTICAL ANALYSIS OF ESTUARINE PROFILES: APPLICATION TO MANGANESE AND AMMONIUM IN THE TAMAR ESTUARY,
Marine Biological Association of the United Kingdom, Plymouth (England). Plymouth Lab.
For primary bibliographic entry see Field 2L.
W83-01154

GROUND WATER GEOCHEMISTRY OF 228RA, 226RA, AND 222RN,
South Carolina Univ., Columbia. Dept. of Geology.
For primary bibliographic entry see Field 5A.
W83-01157

INTERPRETATION OF PH AND EH TRENDS IN A FLUVIAL-SAND AQUIFER SYSTEM,
Department of the Environment, Ottawa (Ontario). Inland Waters Directorate.
R. E. Jackson, and R. J. Patterson.
Water Resources Research, Vol 18, No 4, p 1255-1268, August, 1982. 10 Fig, 6 Tab, 31 Ref.

Descriptors: *Groundwater recharge, *Aquifer characteristics, Sand, *Fluvial sediments, Acidity, Hydrogeology, Chemical reactions, Carbonates, *Hydrogen ion concentration, *Oxidation-reduction potential.

The hygrogeochemical processes affecting pH and Eh in a fluvial-sand aquifer composed primarily of alumino-silicate minerals are discussed. It is shown that the measured pH reflects hydrogen ion uptake, biotite weathering, and carbonate mineral dissolution. The Eh values are interpreted as being the result of the reduction of initially oxidized groundwater by DOC and/or Fe(II), with subsequent reactions involving sulfate reduction and possibly denitrification. Acid neutralization capacity measurements and X ray diffractograms suggest that acid precipitation recharging the aquifer undergoes a two-step neutralization process. The first step involves reactions with the surfaces of mineral grains, mainly with plagioclase and biotite, and the second step involves an irreversible neutralization, with biotite alteration to vermiculite and carbonate mineral dissociation. Because of the problems of using Pt electrodes in groundwaters it is recommended that Eh measurements be supplemented with dissolved oxygen and sulfide measurements. (Baker-FRC)
W83-01201

WATERSHEDS IN MUSKEG TERRAIN. 1. THE CHEMISTRY OF WATER SYSTEMS,
Alberta Univ., Edmonton. Dept. of Geology.
F. W. Schwartz, and W. A. Milne-Home.
Journal of Hydrology, Vol 57, No 3/4, p 267-290, June, 1982. 15 Fig, 4 Tab, 21 Ref.

Descriptors: *Muskeg, *Chemical composition, *Streamflow, Geochemistry, Geohydrology, Surface water, Groundwater, Runoff, Hartley Creek, Muskeg River, *Alberta, Water quality, Snowmelt, Baseflow, Watersheds, Wetlands, Surface-groundwater relations, Seasonal variation, Glacial drift.

The chemistry of water systems in the Muskeg River basin, Alberta, with emphasis on Hartley Creek, was studied in detail over 3 years. Major ion compositions differ in stream water, groundwater, muskeg water, and surface runoff. Most of the waters are of the Ca-Mg-bicarbonate type. Groundwaters in the glacial drift have higher levels of Ca, Mg, and bicarbonate than muskeg and surface runoff. This is a result of dissolution of carbonates. Groundwaters from bedrock are higher in Na, sulfates, and chlorides than glacial drift groundwaters. Stream water has a chemical composition ranging between that of groundwater aand muskeg/runoff. Streams are at baseflow in winter when groundwter is the only source of streamflow. During this time the chemical compositions of stream water and groundwater are nearly identical. After spring snowmelt, muskeg is an important contributor to streamflow, which assumes a chemical composition similar to that of the standing muskeg water. During snowmelt and storm runoff periods stream water is further diluted from inputs of precipitation and surface runoff. (Cassar-FRC)
W83-01206

CHEMICAL INTERACTIONS BETWEEN FOREST SOILS AND ACIDIC PRECIPITATION DURING A DORMANT SEASON ON WILDCAT RUN WATERSHED IN SOUTHWESTERN PENNSYLVANIA,
Pennsylvania State Univ., University Park. Inst. for Research on Land and Water Resources.
R. T. Leibfried.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-139675, Price codes: A05 in paper copy, A01 in microfiche. Master of Science Thesis in Forest Resources, August 1982. 86 p. 13 Tab, 17 Fig., Append. OWRT B-117-PA (1), 14-34-0001-0277.

Descriptors: *Forest soils, Precipitation, *Soil water, *Water quality, Snowmelt, Rainfall, Soil horizons, Aluminum leaching, *Pennsylvania, Hydrogen ion concentration, *Acidic precipitation, *Chemical interactions, Soil leachate, Wildcat Run Watershed, Buffer, Infiltrating water, Soil series, Percolate chemistry, Dormant season.

In order to assess the chemical interactions between forest soil and acidic precipitation, water samples were collected at the soil surface and beneath organic and mineral soil horizons on Wildcat Run Watershed in southwestern Pennsylvania during the 1980-81 dormant season. Leachate samples were collected from the three major soil series on the watershed (Ernest, Calvin, and Dekalb) using zero-tension pan lysimeters to determine chemical changes produced by the different soil horizons. Mean pH was 4.0, 3.9, and 4.4 for surface snowmelt and rain, organic soil leachate, and mineral soil leachate, respectively; indicating a significant retention of H+ in -1 the mineral soil horizons. Mean aluminum concentration was 0.44, 1.03, and 3.59 mg.l at the same three collection depths. Mineral soil leachate pH was nearly identical to the minimum pH of 4.4 found in poorly buffered streams during peak run-off from snowmelt and winter rain events. At a pH value near 4.4 in the poorly buffered streams the maximum aluminum concentration reached 1.5 mg.l-1 which was less than the concentrations found in the mineral soil leachate but well above the lethal limit for trout. Collection depth was the most important factor affecting percolate chemistry while soil series, size-of-event, and precipitation-type were of lesser importance.
W83-01236

CHEMICAL MODEL OF CASPIAN SEA WATER,
Akademiya Nauk Azerbaidzhanskoi SSR, Baku. B. A. Balakishiyeva, and T. N. Rashidova.
Geochemistry International, Vol 17 No 2, p 133-147, 1980. 9 Tab, 32 Ref.

Descriptors: *Chemical composition, *Ions, *Seawater, *Caspian Sea, Thermodynamics, Metals, Temperature effects, Hydrogen ion concentration, Cations, Anions, Alkali metals, Alkaline earth metals, Heavy metals, Trace metals, Ionic strength, Mixing.

Quantitative relationships between the forms of elements in the Caspian Sea were calculated on the basis of thermodynamics for surface (25 C) and bottom (5 C) conditions, for pH of 7.7, 8.0, 8.2, and 8.4, and for Eh of 0.4 and 0.44. Forms of occurrence of elements in rivers flowing into the Caspian Sea were also calculated for pH 8, Eh 0.44, and 25 C. An increase in ionic strength of the water decreased the proportion of Na, Ca, K, Mg, sulfate, and bicarbonate in the free form and increased the proportion of their complexes. At the higher temperatures, there was a grater degree of dissociation in the following: silicic, phosphoric, boric, chromic, selenic, carbonic, and hydrosulfuric acids; carbonates of Mn and Ni; and hydroxides of Cu, Pb, Be, and Al. Increases in Eh sharply increased the proportion of selenate and chromate forms over other forms of combined Se and Cr, especially at low pH and low temperature. A pH change over the range of this study did not affect the behavior of alkali and alkaline earth metals and Zn, Fe, Al, Ga, Zr, Sn, and Be. However, an increase in pH increased the carbonate forms of Mn and Ni, the hydroxides of cu, Pb, and Al, the percentage of uranyl nitrate complexes, and the degree of dissociation of silicic, phosphoric, chromic, boric, selenic, and hydrosulfuric acids. (Cassar-FRC)
W83-01251

HIGH ABUNDANCE OF ALGAL 24-ETHYL-CHOLESTEROL IN ANTARCTIC LAKE SEDIMENT,
Tokyo Metropolitan Univ. (Japan). Dept. of Chemistry.
For primary bibliographic entry see Field 2H.
W83-01373

MAJOR ION CHEMISTRY OF SOME LARGE CHINESE RIVERS,
Massachusetts Inst. of Tech., Cambridge. Dept. of Earth and Planetary Sciences.
H. Ming-hui, R. F. Stallard, and J. M. Edmond.
Nature (London), Vol 298, No 5874, p 550-553, August, 1982. 2 Fig, 3 Tab, 13 Ref.

Descriptors: *Rivers, *Chemical properties, *Ions, Sulfates, Carbonates, Chiang Jiang River, Quiantang River, *China, Huang He River, Chlorides, Dissolved solids.

Samples were taken from the main channel of the Chiang Jiang at Chungking, above the Gorges, and at Wuhan in the central part of the flood plain. The tributaries are typical carbonate rivers, with alkalinity accounting for over half of the anion balance. Calcium and magnesium are the major cations. In both rivers sulfate is substantially higher than chloride, indicating a major contribution from the dissolution of gypsum and minor halite. The Quiantang, sampled at Hangzhou, is an extreme example of carbonate weathering. Calcium and alkalinity account for over 85% of the cation and anion balances. Thus the chemistry of the major rivers of China is dominated by the weathering of carbonates and evaporites in varying proportions. The effects of the degradation of aluminosilicates are nowhere pronounced. With the exception of

the Huang He the major rivers are free from large scale hydrological development. (Baker-FRC)
W83-01374

VARIATION OF TRACE ELEMENT CONCENTRATION IN RAINWATER WITH RAINFALL RATE AND RAINFALL AMOUNT,
Bhabha Atomic Research Center, Bombay (India). Air Monitoring Section.
For primary bibliographic entry see Field 5A.
W83-01379

2L. Estuaries

AN ASSESSMENT OF THE IMPORTANCE OF SOME PARAMETERS FOR SEAWATER INTRUSION IN AQUIFERS AND A COMPARISON OF DISPERSIVE AND SHARP-INTERFACE MODELLING APPROACHES,
James Cook Univ. of North Queensland, Townsville (Australia).
For primary bibliographic entry see Field 2F.
W83-01051

LOW-FREQUENCY VARIATIONS IN SEA LEVEL AND CURRENTS IN SOUTH SAN FRANCISCO BAY,
Geological Survey, Menlo Park, CA.
R. A. Walters.
Journal of Physical Oceanography, Vol 12, No 7, p 658-668, July, 1982. 8 Fig, 3 Tab, 17 Ref.

Descriptors: *Sea level, *Currents, *Tidal effects, Estuaries, San Francisco Bay, Water level, Water currents, Wind-driven currents, Bays, Variability, Wind, *California.

Sea level and current meter data for south San Francisco Bay, a drowned river valley, were analyzed. The low-frequency variations in sea level are dominated by non-local coastal forcing. Locally generated wind setup, especially from westerly to northerly winds, has a small effect on sea level. The low-frequency variation in currents is dominated by a tidally forced residual current and a wind-driven current. The tidally forced current accounts for the long-term circulation pattern and is perturbed by 2-3 day meteorological events. These conditions apply to late spring and summer conditions, not considering storm events. However, winter storms may have significant effects. (Cassar-FRC)
W83-01057

LABORATORY INVESTIGATION OF THE STRUCTURE OF THE FLOW AND BOTTOM FEATURES IN RIVER MOUTH REGIONS,
Moscow State Univ. (USSR). Hdrophysical Lab.
For primary bibliographic entry see Field 2E.
W83-01099

STRUCTURAL ANALYSIS OF FOULING COMMUNITY DEVELOPMENT IN THE DAMARISCOTTA RIVER ESTUARY, MAINE,
EG and G Environmental Consultants, Inc., Waltham, MA.
B. Field.
Journal of Experimental Marine Biology and Ecology, Vol 57, No 1, p 25-33, 1982. 2 Fig, 3 Tab, 33 Ref.

Descriptors: *Fouling, *Invertebrates, Estuaries, *Damariscotta River Estuary, *Maine, Species diversity, Species composition, Succession, Barnacles, Bryozoans, Tunicates, Hydroids, Regression analysis, Cluster analysis.

The development of a marine fouling community was followed on asbestos plates submerged in Dodge Cove, Damariscotta Estuary, Maine, from August 1976 to January 1978. The fouling community was subdivided into primary, which attaches directly to the substrate, and secondary, which lives on and among the primary fouling assemblage. Date were analyzed using cluster analysis. Multiple regression was used to relate the structure of the secondary fouling community to the biological and abiotic factors affecting it. Primary colonizers such as bryozoans (encrusters and branchers), tunicated (fleshing organisms), and hydroids (branchers, bivalves, polychaetes, and barnacles) altered the substrate and made it available for other species unable to settle on a smooth surface. Many of the colonizers trap sediment inviting to infaunal species. Both assemblages showed a general increase in number and diversity of species with time; dominance decreased with time. The number and diversity of secondary foulers was dependent on several factors, given in decreasing order of importance: branchers, barnacles, time, temperature, and encrusters. (Cassar-FRC)
W83-01117

THE SPECIATION OF IONS IN TIBER RIVER ESTUARY WATERS,
Miami Univ., FL.
For primary bibliographic entry see Field 5B.
W83-01118

DEEP WATER RENEWALS AND OXYGEN CONSUMPTION IN AN ALASKAN FJORD,
Alaska Univ., Fairbanks. Inst. of Marine Science.
D. T. Heggie, and D. C. Burrell.
Estuarine, Coastal and Shelf Science, Vol 13, No 1, p 83-99, July, 1981, 12 Fig, 3 Tab, 16 Ref.

Descriptors: *Deep water, *Oxygen requirements, *Fjords, *Alaska, Resurrection Bay, Bays, Seasonal variation, Continental shelf, Phytoplankton, Productivity, Primary Productivity, Oxidation, Bottom water.

The residence time of waters in estuaries is an important control on the flux of river borne matter between the estuary and the open ocean. Water renewal times and oxygen consumption were analyzed in Resurrection Bay, a single-silled fjord on the south central Alaskan coastline. The Bay is about 30 km long, and 6-8 km wide. The weather in the area is primarily controlled by that over the adjacent Gulf of Alaska, but mountains on either side in excess of 1000 m tend to channel local winds axially. Summer winds are southerly, while the reverse holds through the winter. Freshwater runoff from the Resurrection River occurs principally between July and September, and monthly mean discharge rates of about 2000 cubic m/sec are estimated at about 2% of the tidal prism; the latter is less than 5% of the volume of the fjord. Deep and bottom waters are generally renewed annually by inflows of dense water during summer and fall. Renewals are related to seasonal variations in the density of continental shelf source water. Density maxima in summer results from a relaxation of a winter coastal downwelling condition. Deep water renewals may begin as early as April-May and are complete by September-October. During 1973 renewals were sufficient to replace the topographic basin volume 3-4 times over, but were less by half during the same period in 1974. Oxygen consumption rates in the bottom 100 m of the water column were highest during fall and early winter following summer phytoplankton production and were less during late winter and spring. Consumption rates 10 m above the sediments were about double the deep basin estimates, and about 30% of the in situ annual primary production was oxidized in the fjord bottom waters and underlying surface sediments. (Baker-FRC)
W83-01119

LABORATORY SIMULATION OF CHEMICAL PROCESSES INDUCED BY ESTUARINE MIXING: THE BEHAVIOUR OF IRON AND PHOSPHATE IN ESTUARIES,
Institute for Marine Environmental Research, Plymouth (England).
A. J. Bale, and A. W. Morris.
Estuarine, Coastal and Shelf Science, Vol 13, No 1, p 1-10, July, 1981. 3 Fig, 2 Tab, 33 Ref.

Descriptors: *Estuarine environment, *Chemical reactions, *Mixing, *Iron, *Phosphate, Simulation, Chemical composition, Estuaries, Laboratory Studies.

Realistic reproductions of the well characterized behavior of iron and phosphate during estuarine mixing have been achieved in the laboratory using a simulator consisting of a series of five tank reactors, each well stirred. Each reactor is a 3 liter borosilicate glass beaker modified by the inclusion of a side-arm. Continuous monitoring of chemical components in the tank reactors is obtained using ion-specific electrodes. Stationary state mixing was developed between freshwater and estuarine waters of salinity about 3 o/oo at temperatures of 9, 14, and 23 C. The resultant reactive phosphate and total iron concentrations passing a 0.45-microm pore-size membrane filter for each reactor were compared. Significant removal of both reactive phosphate and total iron passing the filter occurred throughout the mixing series, although the percentage loss of iron appeared to have been independent of temperature. Reactive phosphate loss was accentuated by increasing temperature. Following the establishment of mixing equilibria and measurements of reactive phosphate and total iron concentrations, inter-reactor transfers were stopped, but stirring of each reactor was continued. Changes in the concentrations of reactive phosphate and total iron within each reactor were subsequently followed over a 24 hr period. It was found that concentrations of iron and phosphate generally remained within 5% of their starting values, and no consistent trends were evident. (Baker-FRC)
W83-01120

STABLE DENSITY FRONTS AND DINOFLAGELLATE PATCHES IN A TIDAL ESTUARY,
Washington Univ., Seattle. Coll. of Ocean and Fisheries Science.
L. S. Incze, and C. M. Yentsch.
Estuarine, Coastal and Shelf Science, Vol 13, No 5, p 547-556, November, 1981. 3 Fig, 21 Ref.

Descriptors: *Estuarine environment, *Dinoflagellates, *Density currents, *Tidewater, Plankton, Red tide, *Eutrophication, *Maine, Coastal waters.

The possibility that the observed behavior of dense surface patches of dinoflagellates in the upper estuary of the Damariscotta River in Maine could be related to changes in the vertical stability of the water during various stages of the tide was examined. Evidence presented here indicates that changes in mixing regimes which can take place over comparatively short distances can give rise to substantial differences in spatial distribution of dinoflagellates, including the species responsible for toxin in shellfish along coastlines in the western Gulf of Maine. It is noted that the sampling opportunities during these initial studies were limited. However, the development and longevity of the observed patches appeared to be critically tied to the proper phasing of a non-spring-tide series, adequate thermal and freshwater buoyancy input, and other factors favorable to these organisms. The data suggest that the development of such patches within this region of this estuary should be fairly predictable. No significant introduction of dinoflagellates to this region was apparent during these studies. It seemed that the patches resulted primarily from changes in the physical behavior of the system at a time when dinoflagellates were present, although these changes were probably coupled with some population growth of the dominant species. Both frontal types described in this study apparently provided physical conditions conducive to the accumulation of dinoflagellates within relatively confined areas, and neither seemed to favor a different dominant species. (Baker-FRC)
W83-01121

ENERGY FLOW IN THE YTHAN ESTUARY, ABERDEENSHIRE, SCOTLAND,
Port Elizabeth Univ. (South Africa). Dept. of Zoology.
D. Baird, and H. Milne.
Estuarine, Coastal and Shelf Science, Vol 13, No 4, p 455-472, October, 1981. 5 Fig, 34 Tab, 76 Ref.

Descriptors: *Estuarine environment, *Energy, *Productivity, Nutrients, Carbon, Nitrogen, Detritus, Organic matter, Ythan Estuary, *Scotland, Benthos, Algae, Phytoplankton.

A steady-state energy flow model has been constructed for the Ythan estuary. The estuary is located about 20 km north of Aberdeen and is tidal for about 8 km from the mouth. Maximum width of the estuary is 620 m at the Sleek of Tarty but averages about 300 m wide throughout its length, with a mean depth of 2.5 m at high tide. Four small tributary burns flow into the estuary, and the river presently receives about 1500 cu m of primary treated sewage per day from Ellon and Newburgh. Nutrient and particulate organic carbon flux were investigated in terms of freshwater drainage and tidal action. No rates of retention, however, could be provided. Organic C to organic N ratios of detritus vary from 1:14 to 1:200 in the water column, while this ratio is 1:8 in the sediments of the mudflats. Primary production by benthic macrophytes, benthic algae and phytoplankton amounts to 631 g C/sq m/yr, while the production for xooplankton is 0.8 g C/sq m/yr, for meiofauna 19.5 g C/sq m/yr, and for macrofauna 48.8 C/sq m/yr. The efficiency of energy transfer between the invertebrate macrofauna and vertebrate predators approximates 54.2%, which is higher than that recorded heretofore in various aquatic ecosystems. (Baker-FRC)
W83-01122

URANIUM, THORIUM AND LEAD NUCLIDES IN A DELAWARE SALT MARSH SEDIMENT,
Delaware Univ., Newark. Coll. of Marine Studies.
For primary bibliographic entry see Field 5B.
W83-01123

TIDAL EXPORT OF PARTICULATE ORGANIC MATTER FROM A NORTHERN AUSTRALIAN MANGROVE SYSTEM,
Australian Inst. of Marine Sciences., Townsville.
K. G. Boto, and J. S. Bunt.
Estuarine, Coastal and Shelf Science, Vol 13, No 3, p 247-255, September, 1981, 4 Fig, 12 Ref.

Descriptors: *Particulate matter, *Mangrove swamps, *Tidal effects, Organic matter, Chlorophyll, Adenosine triphosphate, Carbon cycle, *Australia, Estuarine environment, Litter.

Carbon and nitrogen budgets were investigated for a mangrove system in north Queensland. In this particular mangrove estuary extensive litter fall statistics are available. The mangrove forest is some 500 ha and is drained by a tidal channel approximately 6 km long and 160 m in width at the mouth. This area is a subunit of a larger mangrove forest system occupying an area of about 50 sq km. A series of tidal channels drains these forests. The only waterway with significant freshwater input is Bowen Creek. A total of at least 26 mangrove species occur in these forests. Flushing of the mangrove litter by the tides probably represents the major form of particulate carbon and nitrogen export. From the observed average litter fall rate of 2.44 g/sq m/day for this area and from the survey data which shows an area of about 400 ha inundated on an average high tide, the annual net export of litter from the basin was estimated to be 3560 metric tons, which is equivalent to a rate of 19.5 kg/ha/day. The litter is effectively removed from the system via tidal action. The effect of grazing and decomposition is minor. The nature of the microparticulate matter is described with particular reference to the variation of total organic carbon, adenosine triphosphate and chlorophyll during a tidal cycle. (Baker-FRC)
W83-01124

ACCUMULATION OF PLANT NUTRIENTS AND HEAVY METALS THROUGH SEDIMENTATION PROCESSES AND ACCRETION IN A LOUISIANA SALT MARSH,
Louisiana State Univ., Baton Rouge. Center for Wetland Resources.
R. D. DeLaune, C. N. Reddy, and W. H. Patrick, Jr.
Estuaries, Vol 4, No 4, p 328-334, December, 1981. 1 Ffig, 5 Tab, 15 Ref.

Descriptors: *Nutrients, *Heavy metals, *Accretion, Marshes, Estuaries, *Salt marshes, Wetlands, *Louisiana, Nitrogen, Phosphorus, Organic matter, Metals, Sedimentation, Barataria Basin.

Accretion rates for some Barataria Basin, Louisiana, salt marsh sites were 1.35 cm per year in a location 7 m from a stream (streamside marsh), 0.75 cm per year at a site 45 m from the stream (inland marsh), and 1.10 cm per year in adjacent Airplane Lake. These accretion rates were approximately equal to the subsidence rates. Plant nutrients and heavy metals were deposited by sedimentation. Average concentrations of nutrients (in mg per g) were: nitrogen-streamside marsh 6.23, inland marsh 8.75, and lake 2.46; phosphorus-0.49-0.52; and organic carbon-streamside marsh 11.2, inland marsh 15.6, and lake 3.8. Average heavy metals concentrations (micrograms per g) were characteristic of pristine marshes: Fe, 13-21; Mn, 87-243; Cd, 1.7-2.0; Pb, 23-28; Cu, 13-18; and Zn, 66-81. Accumulation rates for nutrients (in g per sq m per year) for the streamside marsh, inland marsh, and lake, respectively, were: nitrogen, 21, 13.4, and 15.3; organic matter, 678, 409, and 398; and phosphorus, 1.7, 0.8, and 3.2. (Cassar-FRC)
W83-01125

RELATIONSHIPS BETWEEN ORGANICALLY BOUND CU MN IN SETTLING PARTICULATE MATTER AND BIOLOGICAL PROCESSES IN A SUBARCTIC ESTUARY,
National Oceanic and Atmospheric Administration, Seattle, WA. Pacific Marine Environmental Lab.
R. A. Feely, A. J. Chester, A. J. Paulson, and J. D. Larrance.
Estuaries, Vol 5, No 1, p 74-80, March, 1982. 2 Fig, 1 Tab, 25 Ref.

Descriptors: *Metals, *Particulate matter, *Zooplankton, Copper, Manganese, Trace metals, Heavy metals, Estuaries, Kachemak Bay, Lower Cook Inlet, *Alaska, Organic matter, Population dynamics. Phytoplankton, Primary productivity, Productivity, Organic carbon, Feces, Sedimentation.

Zooplankton fecal pellets were a major mechanism in the transfer of trace metals from the water column to the sediments in Kachemak Bay, loaded in Lower Cook Inlet, Alaska. Plankton and short-term (5-6 days) sediment trap studies were conducted in March-August 1978. Primary productivity was maximum in May and decreased throughout the summer. The concentrations of organically bound Cu and Mn in sediment trap particulate matter and the fecal pellet production increased throughout the summer to a maximum in August. The fluxes of total particulate matter and organic carbon reached a maximum in June, increasing 30% from May to June. The fluxes of organically bound Cu and Mn and fecal pellets were 200%, 360%, and 760%, respectively, higher in August than in May. Daily fluxes in August were: Cu, 85 micrograms per sq m; Mn, 1530 micrograms per sq m; and fecal pellets, 3.1 million per sq m. These results suggest that the enrichment of Cu and Mn in organic particulate matter during August was a result of bioaccumulation of these metals into fecal material. (Cassar-FRC)
W83-01126

INFLUENCE OF PH ON THE FLUORESCENCE OF DISSOLVED ORGANIC MATTER,
Nederlands Inst. voor Onderzoek der Zee, Texel. Biological Research Ems-Dollart Estuary.
R. W. P. M. Laane.
Marine Chemistry, Vol 11, No 4, p 395-401, 1982. 3 Fig, 18 Ref.

Descriptors: *Fluorescence, *Organic matter, *Hydrogen ion concentration, Estuaries, Ems-Dollart Estuary, *The Netherlands, Seasonal variation.

The influence of pH over the natural range of 7-9 was investigated during two surveys (June 1980 and March 1981) in the Ems-Dollart Estuary, the Netherlands. There was a mean increase of 16.4% in millifluorescence from pH 7 to 9. An equation was derived to express the fluorescence at a fixed pH in terms of the measured fluorescence at any pH. Fluorescence intensity and position of the emission maximum were the same at a given pH in spite of two cycles of pH changes. This proved that the original structure of the fluorescent matter had not been altered by pH changes. Two slopes were evident in the pH-fluorescence curve, one at pH 8 suggesting ionization of an ammonium and/or phenol group, and one at pH 3 suggesting the ionization of sulfonyl and/or carboxylic acids. These results indicate that fluorescent matter is mainly allochthonous and behaves conservatively during transport through the estuary. Further work is required to determine whether fluorescent matter is produced in situ. (Cassar-FRC)
W83-01128

RESPONSES OF EXPERIMENTAL ESTUARINE COMMUNITIES TO CONTINUOUS CHLORINATION,
Environmental Research Lab., John's Island, SC. Bears Bluff Field Station.
For primary bibliographic entry see Field 5C.
W83-01131

MECHANISM GOVERNING THE ESTUARINE CIRCULATION IN DEEP, STRONGLY STRATIFIED FJORDS,
Goeteborg Univ. (Sweden). Dept. of Oceanography.
A. Stigebrandt.
Estuarine, Coastal and Shelf Science, Vol. 13, No. 2, p 197-211, August, 1981. 6 Fig, 1 Tab, 16 Ref.

Descriptors: *Fjords, *Water circulation, *Model studies, Stratification, Estuarine environment, Estuaries, Mixing, Vertical distribution, Brackish waters, Salinity, Runoff, Mathematical equations, Density, *Sweden, Nordfjord.

A simple but physically realistic model for steady estuarine circulation has been developed. The new model is based on an already existing model for steady estuarine circulation in a wide fjord, a particularly simple system as horizontal gradients within the fjord are small. Salinity and depth of the brackish layer are supposed to be horizontally homogeneous. For the present model it is argued that a two-layer description of fjord stratification is correct for very wide fjords and possibly also in narrow fjords with high runoff and/or weak mixing. Among other findings from the theory is that the thickness of the brackish layer is primarily determined by the internal hydraulic control for high specific runoff and weak mixing. At the other extreme, with low specific runoff and strong mixing, the thickness of the brackish layer was found to be proportional to the Monin-Obukhov length. Circulation in not very wide fjords is also discussed. It is found that recirculation in the brackish layer may be expected, whereby a two-layer description of the flow field breaks down at least locally. A critical Rayleigh number that seems to control the recirculation of brackish water within the fjord is found. A theory for the density difference between the mouth and the head of the brackish layer in the fjord is developed from the critical Rayleigh number condition. This density difference is normally proportional to the density difference between the brackish water at the mouth and the underlying sea water, provided that the river runoff is not too heavy and/or the mixing is not too weak. This prediction is confirmed by extensive measurements from the Nordfjord. (Baker-FRC)
W83-01132

MATHEMATICAL MODEL FOR PARTIALLY MIXED ESTUARIES USING THE TURBULENCE ENERGY EQUATION,
Institute of Oceanographic Sciences, Birkenhead (England).
T. J. Smith, and H. S. Takhar.
Estuarine, Coastal and Shelf Science, Vol. 13, No. 1, p 27-45, July, 1981. 8 Fig, 54 Ref.

Descriptors: *Estuarine environment, *Model studies, *Turbulence, *Turbidity, *Mathematical equations, Mathematical studies, Mixing, Estuaries, Reynolds number, *Stratification, Density stratification, Viscosity, *Salinity.

The model for width averaged tidal flow as described by Smith and Takhar in 1979 has been extended to include the effects of density stratifica-

tion. The model is applied to an idealized estuary with the aims of demonstrating the characteristics of turbulence closure models in partially mixed tidal flows and assessing their advantages over mixing length closures due to their increased generality. To reduce the computational effort without any loss of generality of the results, a two-dimensional, width-averaged approximation was used. The model was then applied to an idealized estuary similar in topography to the Rotterdam Waterway, the Netherlands, for which the dispersion due to lateral mean velocity shear and lateral salinity variations had been shown to be negligible. The model as developed was based on the laterally integrated momentum, continuity and salt balance equations. The dominant Reynolds stress and the vertical turbulent transport of salt were modelled by an effective diffusion hypothesis in which the eddy coefficients were determined from the solution of the turbulence energy equation. The efects of density stratification on the turbulence energy, the eddy viscosity and the turbulent Schmidt number were included. During model application, the dispersion coefficient was identified as an important parameter in quantifying both the horizontal and vertical structure of the flow and salinity distributions in laterally integrated representations of partially mixed estuaries. (Baker-FRC)
W83-01133

A NOTE ON TIDAL ASYMMETRY IN THE SEVERN ESTUARY,
Institute for Marine Environmental Research, Plymouth (England).
R. J. Uncles.
Estuarine, Coastal and Shelf Science, Vol. 13, No. 4, p 419-432, October, 1981. 4 Fig, 8 Ref.

Descriptors: *Estuarine environment, *Tidal hydraulics, Water currents, Water circulation, Numerical analysis, Severn Estuary, *England.

A one-dimensional, non-linear numerical model is used to investigate the tidally averaged frictional stress and set-up of water level due to tidal asymmetry in the Severn Estuary. These quantities depend on the overtides in the region. A linearized model of the overtides is applied to calculations of the M4 currents in order to delineate the mechanisms responsible for their generation. The relative importance of individual non-linear mechanisms to the tidally averaged stress and set-up is determined. These mechanisms are interactions between tidal flow and changes in depth or breadth over a cross-section, frictional interaction between the tidal flow and Stokes drift, interaction between the tidal fluctuations in water depth and frictional retardation, and non-linear advection. (Baker-FRC)
W83-01134

SIMULATING THE LATERAL TRANSPORT OF ICHTHYOPLANKTON IN THE POTOMAC ESTUARY,
Maryland Univ., Solomons, Center for Environmental and Estuarine Studies.
R. E. Ulanowicz, J. M. Lindsay, W. C. Caplins, and T. T. Polgar.
Estuaries, Vol. 5, No.1, p 57-67, March, 1982. 6 Fig, 19 Ref.

Descriptors: *Entrainment, *Fish eggs, *Environmental effects, Larvae, Eggs, Ichthyoplankton, Plankton, Estuaries, Nuclear powerplants, Cooling water, Intakes, Powerplants, Model studies, Hydrodynamics, Douglas Point Nuclear Station, *Maryland, Bass, *Potomac estuary.

Two-dimensional, vertically-averaged hydrodynamic and kinematic models of passive organism transport were developed to represent advective and dispersive processes at the proposed Douglas Point Nuclear Generating Station, Maryland. This more refined model did not produce significantly better estimates of ichthyoplankton (striped bass) entrainment than coarser models, because the volume of cooling water withdrawal was only a small fraction (2.25 cu m per sec) of the average flow rate (370 cu m per sec) and peak tidal flow (6500 cu m per sec). However, the model was able to predict entrainment rates of 0.6% to 2.6% on opposite sides of the estuary. (Cassar-FRC)
W83-01136

THE STRUCTURE OF TWO SOUTH CAROLINA ESTUARINE TIDE POOL FISH ASSEMBLAGES,
South Carolina Univ., Columbia.
R. E. Crabtree, and J. M. Dean.
Estuaries, Vol. 5, No. 1, p 2-9, March, 1982. 3 Fig, 6 Tab, 16 Ref.

Descriptors: *Tidal rivers, *Fish populations, Estuaries, North Edisto River, *South Carolina, Leadenwah Pool, Rivers, Tidal marshes.

The fish assemblages of two tidal pools (North Edisto and Leadenwah) on the North Edisto Estuary, South Carolina, were sampled by haul seine, lift net, and channel net. In June-October 1977 samples were collected during daytime low tides; in June-July 1978, during daytime high tides. In Leadenwah Pool a total of 6686 fish comprising 18 species were caught; in North Edisto, 10,461 fish comprising 31 species. Dominant species were Fundulus heteroclitus, Leiostomus xanthurus, Menidia menidia, and Anchoa mitchilli. Areas of oyster substrate were dominated numerically by Gobiosoma bosci and F. heteroclitus. The fish assemblage was similar to that found in other tidal creeks, but was different from that obtained by otter trawl sampling in the deeper river water. (Cassar-FRC)
W83-01137

THE DEPOSITION OF WINDSCALE RADIOCAESIUM IN THE WYRE ESTUARY AND THE MEASUREMENT OF SEDIMENTATION RATES,
International Lab. of Marine Radioactivity, Monte Carlo (Monaco). Oceanographic Museum.
For primary bibliographic entry see Field 5B.
W83-01138

OHIWA HARBOUR, NATURAL VALUES,
Ministry of Agriculture and Fisheries Auckland (New Zealand). Fisheries Management Div.
For primary bibliographic entry see Field 6G.
W83-01146

AN IMPROVED METHOD OF DETERMINING SEDIMENTATION RATES BY THE USE OF ARTIFICIAL RADIONUCLIDES,
Lancaster Univ., Bailrigg (England). Dept. of Environment Sciences.
For primary bibliographic entry see Field 2J.
W83-01153

STATISTICAL ANALYSIS OF ESTUARINE PROFILES: APPLICATION TO MANGANESE AND AMMONIUM IN THE TAMAR ESTUARY,
Marine Biological Association of the United Kingdom, Plymouth (England). Plymouth Lab.
S. Knox, D. R. Turner, A. G. Dickson, M. I. Liddicoat, and M. Whitfield.
Estuarine, Coastal and Shelf Science, Vol 13, No 4, p 357-371, October, 1981. 9 Fig, 5 Tab, 18 Ref.

Descriptors: *Estuaries, *Model studies, *Manganese, *Ammonium, Tamar Estuary, Estuarine environment, *Chemical analysis, *Statistical analysis, Mathematical studies, Interstitial water, Mixing, Predictions, Projections, *England.

A model for the formation of manganese and ammonium maxima in the Tamar Estuary was investigated. By selecting two chemical components that can be postulated to arise from the same source it has been possible to present a simple and largely objective approach to the analysis of field data that avoids placing undue weight on the potentially variable end-members and yields mean values for the concentration ratios of the components of interest in the water column. The simple statistical model also enables these ratios to be compared with corresponding ratios measured directly in the interstitial water that is postulated as providing the source of the dissolved components. By combining these independent sets of information it is possible to provide a clear and consistent account of the major processes responsible for manganese and ammonium ion profiles in the Tamar Estuary. It is suggested that this approach is more fruitful than the subjective analysis of concentration profiles by comparing the data visually to hypothetical ideal mixing lines. (Baker-FRC)
W83-01154

PRIMARY PRODUCTION IN A TURBID ESTUARY,
Institute for Marine Environmental Research, Plymouth (England).
I. R. Joint, and A. J. Pomroy.
Estuarine, Coastal and Shelf Science, Vol 13, No 3, p 303-316, September, 1981. 7 Fig, 4 Tab, 25 Ref.

Descriptors: *Primary productivity, *Estuarine environment, *Turbidity, Bristol Channel, *England, Euphotic zone, Zones, Phytoplankton, Chlorophyll A, Nutrients.

Primary production is described in the Bristol Channel, England, a very turbid estuary with a large riverine input of inorganic nutrients and a long flushing time. The study was made to quantify the phytoplankton production of the area and to supply data on phytoplankton standing stocks and rates of primary production for use in a general ecosystem simulation model of the Bristol Channel which has been developed to simulate the flow of energy through the ecosystem. The euphotic zone extends from less than 0.5 m to greater than 10 m. The standing stock of phytoplankton chlorophyll a was measured in 1973 and 1974 and was similar throughout the Bristol Channel, but the rate of primary production was 6.8 g C/sq m for the most turbid region and 164.9 g C/sq m for the Outer Bristol Channel. A larger proportion of the annual primary production occurred in the spring in the Outer Channel compared to the most turbid regions. Phaeocystis developed into blooms in some, but not all, years and exhibited a different light saturation curve from other phytoplankton populations. Serial incubations of short duration gave higher fixation rates than day long incubations, and it is argued that photoinhibition is probably insignificant in a mixed water column. Excretion rates of dissolved organic carbon by phytoplankton were always low. (Baker-FRC)
W83-01155

DYNAMICS OF MUD (SLICK) AND SUSPENDED MATTER IN ESTUARIES. APPLICABILITY OF BY-PRODUCTS OF SURVEYS OF GERMAN COASTAL AGENCIES IN VIEW OF REQUIREMENTS FOR FUTURE NEEDS,
Deutsches Hydrographisches Inst., Hamburg (Germany, F.R.).
For primary bibliographic entry see Field 2J.
W83-01161

THE ESTUARINE ZONE, AN OVERVIEW,
Canterbury Univ., Christchurch (New Zealand). Dept. of Zoology.
G. A. Knox.
Soil and Water, Vol 16, No 2, p 13-17, April, 1980. 2 Fig.

Descriptors: *Estuaries, *Water pollution effects, *Water resources development, Water quality, Industrial wastes, Environmental effects, *New Zealand.

An estuarine system includes the water body, or basin, and the marginal areas around its edge which are flooded by the tides and storms. This marginal area includes the tideflats and mud flats, the tidal salt marshes and mangroves, and the upper wetlands. Estuarine circulation patterns and salinity distributions are among the most distinctive known patterns of water movement. Estuarine sediments are unique, having specific characteristics and high complexity. The most significant characteristic of the true estuarine environment is the instability of the system, and this determines the main biological features. Estuaries are particularly valuable in the overall economy of coastal water. Some of the most important producers at the base of the food chain live in the estuaries. Estuarine environments are particularly vulnerable to human impact. Their vulnerability lies in the sensitivity of the life that thrives in them and the

fact that they are a natural pollutant trap. Estuaries throughout the world have always been preferred sites for human settlement. All large coastal cities in New Zealand are situated on estuarine water bodies; thus the estuaries have often been subjected to the most intensive use applied to any marine area. The future of estuaries calls for increasing care and understanding in their management. (Baker-FRC)
W83-01163

VELOCITY VARIATIONS IN SALT MARSH CREEKS, NORFOLK, ENGLAND,
Edinburgh Univ. (Scotland). Dept. of Geography.
R. G. Healey, K. Pye, D. R. Stoddart, and T. P. Bayliss-Smith.
Estuarine, Coastal and Shelf Science, Vol 13, No 5, p 535-545, November, 1981. 8 Fig, 8 Ref.

Descriptors: Salt marshes, *Velocity, *Geomorphology, Norfolk, *England, Coastal waters, Tidal flows, Warham marshes.

The importance of velocity pulses on the flood and ebb tides in salt marsh creeks has been noted in several studies, but no satisfactory explanation of the causal mechanisms has been made as yet. This paper presents a critical analysis of existing models in the light of new field data from the Warham marshes, Norfolk, England. Although continuity models have the advantage of providing a simple picture of tidal flows in salt marsh creeks, which allows predictions to be made about velocity changes, the data presently available suggests that they may invert part of the causal sequence linking the hydraulic variables. The continuity approach suggests that velocity is a function of the rate of tidal stage rise, which is considered to be an independent variable, whereas field data suggest that velocity via discharge partly controls the rate of tidal stage rise within the marsh system. Field observations made at Warham have also shown that the asymmetries of below marsh and over marsh tides differ significantly, and that the shape of the stage-time curves is partly influenced by the movement of water across the marsh surface. The preliminary findings suggest that water surface slopes may play a bigger role in the generation of velocity pulses than has been generally recognized, but further data are required before their precise importance can be clarified. (Baker-FRC)
W83-01176

THE TIDAL INSTRUSION FRONT: AN ESTUARINE CONVERGENCE ZONE,
University Coll. of North Wales, Bangor. Marine Science Labs.
J. H. Simpson, and R. A. Nunes.
Estuarine, Coastal and Shelf Science, Vol 13, No 3, p 257-266, September, 1981. 7 Fig, 9 Ref.

Descriptors: *Estuarine environment, *Tidal floods, *Tidal currents, *Density currents, Water currents, Density, Water circulation, *Wales, River Seiont.

Freshwater discharge in a small estuary flows seaward as a density current, which is forced back into the estuary during the flood phase of the tidal streams. The development of the two layer flow and the associated frontal structure is described. The front exhibits a V configuration, with an isolated point convergence at its apex and an associated gyre system. Representative examples of the two-layer structure show that it extends upstream of the front, with about 50 cm of freshwater overlying the intruding straits water which has a salinity of about 32 o/oo. A region of intense surface gradients occurs at the transition to the almost vertically uniform high salinity regime. At this point the intruding saline water can be seen plunging below the freshwater layer with an intense surface convergence, clearly identified by accumulations of surface material. Just upstream of this point there is a system of eddies in which the collected surface material rotates. At times a pair of symmetrical vortices are apparent, but more frequently a single eddy predominates. Surface flow relative to the front is toward it on both sides. On reaching the front, surface freshwater sinks and is swept back upstream. In calm conditions a train of capillary waves may sometimes be observed just downstream of the advancing freshwater. (Baker-FRC)
W83-01177

IN SITU SURVIVAL OF ENTERIC BACTERIA IN ESTUARINE ENVIRONMENTS OF DIFFERENT NUTRIENT CHARACTERISTICS,
Virginia Inst. of Marine Science, Gloucester Point.
M. W. Rhodes, and H. I. Kator.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-140038, Price codes: A04 in paper copy, A01 in microfiche. Completion Report, October, 1982. 47 p, 11 Fig, 1 Tab, 62 Ref. OWRT A-093-VA(1).

Descriptors: *Fecal coliforms, *Enteric bacteria, *Pathogenic bacteria, Estuaries, Shellfish, *Sublethal stress, Lethal limit, Virginia, Ware River, Sewage outfalls, Water pollution effects, *Escherichia coli, *Salmonella spp.

Survival and development of sublethal stress were determined for Escherichia coli and Salmonella spp. exposed in membrane diffusion chambers to estuarine waters of different chemical and physical characteristics. Sublethal stress was assessed using direct selective versus resuscitative enumeration procedures and an electrochemical detection method. In general, increased survival and decreased stress resulted from exposure in a shallow tidal creek 4.3 km downstream of a sewage outfall as opposed to a second site located an additional 7.1 km downstream in the Ware River. Dieoff and sublethal stress in filtered estuarine water were inversely related to water temperature. However, salmonella populations exhibited significantly less dieoff and stress than E. coli at water temperatures less than 10 degrees Centigrade. While exposure to autochthonous microbiota reduced densities of both test bacteria, some remained after two weeks exposure at temperatures greater than 15 degrees Centigrade. Survival differences in membrane-filtered versus nonfiltered estuarine water were most pronounced at warmer temperatures. Bacterial dieoff at warm temperatures was associated with increases in microflagellate densities as measured by epifluorescence microscopy and of lytic microorganisms enumerated as plaque-forming units. These studies demonstrated that indicator and pathogenic enteric bacteria can survive for extended periods in estuarine waters and that under adverse conditions of low temperature survival patterns of E. coli and salmonellae may differ significantly. The prolonged persistence of Salmonella spp. as compared to E. coli under cold water conditions suggests that fecal coliforms may be an inadequate indicator of pathogens during the prime months of shellfish harvesting.
W83-01281

THE DEVELOPMENT OF PHYTOPLANKTON POPULATIONS AND NUTRIENTS IN A TIDAL RIVER UNDER DROUGHT CONDITIONS,
Rutgers - The State Univ., New Brunswick, NJ. Dept. of Zoology.
For primary bibliographic entry see Field 5B.
W83-01283

THE DYING ESTUARY,
For primary bibliographic entry see Field 6G.
W83-01291

SOME DIATOMS FROM BRACKISH WATER HABITATS IN SOUTHERN IRAQ,
Sulaimaniyah Univ. (Iraq). Dept. of Biology.
G. C. F. Hinton, and B. K. Maulood.
Nova Hedwigia, Vol 33, No 1-2, p 475-486, 1980. 41 Fig, 1 Tab, 9 Ref.

Descriptors: *Coastal marshes, *Deltas, *Diatoms, *Taxonomy, *Iraq, Marshes, Salt marshes, Estuaries, Rivers, Plankton, Species, Composition, Species diversity, Phytoplankton, Algae, Chrysophyta.

A study of the taxa of a marsh area of Southern Iraq was carried out to identify the planktonic diatoms before drainage of the area in the near future. The area studies was the delta flats of the Tigris and Euphrates Rivers. Water samples for diatom identification were collected from various depths at each of eight stations using a Van Dorm closing sampler. Seventy-seven taxa were recorded from the brackish waters, 67 of which were identified in previous marsh studies. Descriptions of the taxa are supplemented by digrams. (Geiger-FRC)
W83-01306

3. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

CHEMICAL OSMOSIS, REVERSE CHEMICAL OSMOSIS, AND THE ORIGIN OF SUBSURFACE BRINES,
Illinois Univ. at Urbana Champaign. Dept. of Geology.
For primary bibliographic entry see Field 2K.
W83-01143

APPLICATION OF NON-FOULING ULTRAFILTRATION MEMBRANES IN WATER CONVERSION TECHNOLOGY,
H. P. Gregor.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-139998, Price codes: A07 in paper copy, A01 in microfiche. Report, WAPORA, Inc., Chevy Chase, Maryland, Project 642, August 30, 1982. 128 p, 37 Fig, 11 Tab, 43 Ref, 3 Append. OWRT(7517). 14-34-0001-7517(1).

Descriptors: *Ultrafiltration, *Membrane processes, *Desalination, Reverse osmosis, Electrodialysis, Water quality management, Brackish water, Seawater, Saline water.

The most promising technologies available for treating brackish or saline water are the membrane separation processes of reverse osmosis (RO), ultrafiltration (UF), and electrodialysis (ED). The fouling of UF, ED, and RO membranes has been the principal deterrent to their widespread application. A new, non-fouling UF membrane was studied to explore its feasibility in conjunction with conventional wastewater treatment, and its operation in a pilot plant at the Desalting Test Facility in Yuma, Arizona. Initial laboratory tests were carried out with water samples which included salt water, brackish water, synthesized Yuma feed water, and actual Yuma feed water. Further studies were conducted to compare the performance of RO and ED systems with untreated feed water and with feed water pretreated by UF. UF proceeded to a high degree of water recovery in the absence of any flux decline in tests on sea water and brackish water. Results of the RO treatment of Yuma canal water with and without UF pretreatment showed the advantages of this pretreatment water. In pilot plant tests, two connected systems were installed and operated at the Desalting Test facility: a device that performed UF on raw water; and a system consisting of two RO units, one operating on effluent from the pretreatment plant, and the other from the UF device. The shutdown of the Yuma facility forced the termination of these tests. (Moore-SRC)
W83-01277

DEVELOPMENT OF A 100,000 GPD BRACKISH WATER MODULE,
Dow Chemical Co., Walnut Creek, CA. Western Div.
G. B. Clark.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-146704, Price codes: A04 in paper copy, A01 in microfiche. Final Report, March 29, 1981. 67 p, 41 Fig. OWRT C-80323-S(8549)(1).

Descriptors: *Desalination apparatus, *Reverse osmosis, *Computers, Membrane processes, Desalination, Flow characteristics, Hollow fiber reverse osmosis, Water treatment, Brackish water.

A large, computer controlled, helical wound, hollow fiber, reverse osmosis desalting module having improved flow characteristics was developed, fabricated, and tested. A single large 16 x 96 in. module bundle was developed in lieu of two smaller units housed in a common enclosure as was originally proposed. The final module design incorporates two active tubesheets and eliminates dead end tubesheet. Test data confirmed the advantages of helical wound, controlled flow patterns in large module bundles. The 'outside-in' flow provisions in the design resulted in extremely low pressure differentials with polarization effects reduced by over 25%. The final module assembly, equal in production to six commercial modules, is contained within an 18 x 96 in. pressure vessel and is the largest single module, in output, to be produced to date. The final module produced 138,425 gallons per day after 500 hours of testing at 400 psi and 1200 ppm brackish water. A projected 125,000 gallons per day at the end of three years was calculated based on the .013 slope. (Moore-SRC)
W83-01352

ISOLATION AND CONTROL OF MEMBRANE FILTER DEGRADING MICROORGANISMS,
New Mexico State Univ., Las Cruces. Dept of Agronomy.
W. C. Lindemann.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-146407, Price codes: A04 in paper copy, A01 in microfiche. New Mexico Water Resources Research Institute, WRRI Report No 139, Las Cruces, December 1981. 61p, 18 Tab, 33 Ref. OWRT C-90059-D(9508)(1).

Descriptors: *Reverse osmosis, *Desalination, *Cellulose acetate membranes, *Membrane processes, *Microbial degradation, *New Mexico, Microbiological studies, Salt rejection, Water treatment.

Reverse osmosis filtration is one of the most widely used methods of desalinization and cellulose acetate is the most common membrane material. The Roswell Test Facility (New Mexico) reverse osmosis testing program was plagued with premature failure of cellulose acetate reverse osmosis membranes. Microbial degradation of the membranes was thought to be the cause. Microorganisms were isolated from various membranes and waters and tested for their ability to degrade cellulose acetate preparations and membrane strip. None of the microorganisms isolated or enrichment cultures from facility membranes were found to degrade cellulose acetate. The microorganisms isolated were common soil and water inhibitants. Those membranes with high microbial populations generally had good salt rejection capabilities while those membranes with low microbial populations had the greatest decline in salt rejection capabilities. No evidence or microorganisms were found to support the microbial degradation hypothesis during the course of this study. The degradation of cellulose acetate membranes and other possible causes for membrane failure were discussed. (Moore-SRC)
W83-01359

DEVELOPMENT OF NEW CLEANING TECHNIQUES FOR REVERSE OSMOSIS MEMBRANES,
Dow Chemical Co., Walnut Creek, CA.
J. A. Johnson, and T. M. Leahy.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-146746, Price codes: A09 in paper copy, A01 in microfiche. Report, March 30, 1982. 183 p, 52 Fig, 15 Tab, 14 Ref, 5 Append. OWRT C-80152-S(8519)(1). 14-34-0001-8519.

Descriptors: *Reverse osmosis, *Membrane processes, *Cleaning, *Desalination apparatus, San Joaquin River, Brackish water, Suspended solids, Cost analysis, Silt, California.

Reverse osmosis permeators are susceptible to fouling by suspended solids in the feedwater. Several cleaning methods for the control of silt fouling were tested and compared. The flow reversal cleaning method, where a permeator flush stream is periodically switched from a feed-to-brine to a brine-to-feed flow direction, appeared the most effective of the methods tested. When cleaning techniques were combined, cleaning effectiveness was improved slightly. The addition of a surfactant to the cleaning flush stream improved the effectiveness of all of the cleaning methods by an average of 55%. Comparison of performance results between separate testing phases indicates that experimental operating conditions were not consistent between phases. This has been attributed to: seasonal changes in the San Joaquin River feed water; upsets in clarifier operation; and limitations in the ability to measure and control the fouling tendency of the feed water. Scaling of the membrane surface had occurred in some tests. The capital and operating costs associated with applications of the flow reversal with surfactant and the drain/refill with surfactant cleaning techniques on a 0.5 million gpd brackish water reverse osmosis system were developed. Flow reversal cleaning of such a system once every six days, or less, would be economically beneficial. It is believed that the installation of a cleaning system may allow operation on a feedwater with higher than presently acceptable fouling potential, and membrane lifetime may be improved. The availability of an on-line cleaning system may prevent the necessity of membrane replacement in the event of severe pretreatment system upsets. (Moore-SRC)
W83-01369

DESALINATION-POWER CYCLES WITH THE BIPHASE ROTARY SEPARATOR TURBINE, PHASE 3,
Biphase Energy Systems, Santa Monica, CA.
P. L. Limburg, E. Walsh, and D. Rovener.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-146753, Price codes: A07 in paper copy, A01 in microfiche. Final Report, February 1982. 121 p, 58 Fig, 7 Tab, 11 Ref. OWRT C-00156-D(0490)(1).

Descriptors: *Fluidized-bed, *Heat-exchanger, *Turbines, Waste-heat-recovery, Scale, Corrosion, Erosion, Rotary-separator turbine, Energy-recovery, *Desalination, *California, San Nicolas Island.

Tests of a fluidized-bed seawater heat exchanger showed that 330 degrees F was the maximum temperature to which seawater could be heated without scale formation in the bed during once through flow of seawater. Twelve material and coating combinations were exposed to a two-phase salt-water jet to simulate the environment of rotary-separator-turbine rotor materials. The materials, except for bare aluminum and some brittle coatings, passed four-hour screening tests. A hydraulic version of the Biphase reaction turbine can recover reverse-osmosis reject-brine pressure energy with efficiency of over 70%. A two-phase version can recover pressure energy and provide additional power for pumping from a waste heat source. Integration of a high-pressure reverse-osmosis pump into the turbine is not as efficient as using a separate pump and turbine coupled together. A system configuration was developed for a desalination-power system which uses the waste heat from diesel engines in the power plant at San Nicolas Island, CA.
W83-01370

3B. Water Yield Improvement

EFFECTS OF ARTIFICIAL CONIFER FOLIAGE ON COLLECTION OF PRECIPITATION AND NUTRIENTS IN COASTAL BRITISH COLUMBIA,
Toronto Univ. (Ontario). Dept. of Botany.
For primary bibliographic entry see Field 2I.
W83-01218

THE HYDROGEOLOGY OF ALLUVIAL AQUIFERS IN OR BORDERING THE DISSECTED TILL PLAINS,
Missouri Univ., Columbia. Dept. of Geology.
For primary bibliographic entry see Field 2F.
W83-01269

THE ONFLOW OF IRRIGATION SCHEMES,
Ministry of Agriculture and Fisheries, Ashburton (New Zealand).
J. G. Spall.
Soil and Water, Vol. 17, No. 2, p 17, April, 1981.

Descriptors: *Irrigation engineering, *Water resources development, *Farm management, Evaluation, Ashburton-Lynhurst, Waitaki, Water supply, Available water, Crop yield, Farming, *New Zealand.

The effects of irrigation schemes on the districts in which they are constructed are considered. The development of the Ashburton-Lyndhurst scheme, where water first became available in 1945, is compared with the development of the lower Waitaki plains, where scheme water first became available in 1968. While substantial achievements were made within the irrigation scheme, with increases in stocking rate, farm values, carrying capacity and density of settlement, equally impressive developments occurred in the dryland zone. When these findings were compared to a more recent scheme development area, much faster development was noted in the irrigated area. It was concluded that a great deal of knowledge was gleaned from the earlier systems, and this has helped the newer systems achieve significant development in short periods of time. Some of the development occurring since 1976 include a more to irrigate all irrigable areas on some farms, automation of manual systems, and all-grass wintering. It is felt that only in the 1970s did irrigation farming systems come of age. (Baker-FRC)
W83-01318

MUNICIPAL FRACTURED-ROCK WELLS,
B. Caswell.
Water Well Journal, Vol 36, No 9, p 40-41, September, 1982.

Descriptors: *Water supply development, *Wells, *Geologic fractures, Fault springs, Water supply, Drinking water, Radon, Path of pollutants, Water quality, Well water.

Problems which must be considered in planning to use bedrock wells for municipal water supplies are noted. These concerns include the thought that the sustained (safe) yield is not predictable, and therefore the supply is unreliable; contaminants may move directly into open surface fractures and pollute the supply; contaminants may be transported along unknown faults and fissures from sources that are miles from the well; and the necessary protective zone around the well is indefinable. Another problem which is sometimes voiced concerns the occurrence of radon gas in groundwater from some granitic and metamorphic rocks. If present it may preclude the use of the groundwater unless treatment is offered. Development of fractured-rock aquifers for municipal water supply requires some adjustment and more complete application of existing exploration and analysis techniques. There is no reason for regulatory authorities to assume that fractured-rock aquifers cannot be satisfactory sources of municipal water supply. (Baker-FRC)
W83-01350

3C. Use Of Water Of Impaired Quality

LEGAL ISSUES IN IMPLEMENTING WATER REUSE IN CALIFORNIA,
California Univ., Berkeley.
For primary bibliographic entry see Field 6E.
W83-01074

RESULTS OF PRELIMINARY EXPERIMENTS ON THE INFLUENCE OF FABRICS ON THE MIGRATION OF GROUNDWATER AND WATER-SOLUBLE MINERALS IN THE CAPILLARY FRINGE,
Queen Mary Coll., London (England). Dept. of Geological Science.
For primary bibliographic entry see Field 8G.
W83-01253

3D. Conservation In Domestic and Municipal Use

WATER RESOURCE MANAGEMENT AND CONSERVATION FOR THE FUTURE,
North Carolina State Univ. at Raleigh. Dept. of Psychology.
F. J. Smith, S. P. Gordon, and T. M. Powers.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-139931, Price codes: A08 in paper copy, A01 in microfiche. Water Resources Research Institute of the University of North Carolina Report No 177, July 1982. 168 p, 6 Fig, 27 Tab, 121 Ref, 2 Append. OWRT B-121-NC(1). 14-34-0001-9127.

Descriptors: *Water conservation, *Water management, *Public opinion, *Industrial water, *Water use, *Municipal water, North Carolina, Attitudes, Water resources development, Water shortage, Social aspects.

Water conservation is the focal point for a set of integrated studies that attempt to lay the groundwork for appropriate water resource management for the future. The research includes surveys of water use in homes and industries, organizational analyzed of management perceptions and information needs, evaluation of a community incentives program for conservatio, and systems analysis of conservation behavior. Data for all studies were developed on the basis of a common sample frame consisting of 54 communities across North Carolina: 544 scientific interviews were completed which yielded new information on 726 different variables relating to water resources management and conservation. The survey of heads-of-households, industrial representatives and local water managers confirms that shortages of water supply represent a serious threat to the wellbeing of many North Carolina communities. In the past five years, 28% of households and 20% of industries sampled have suffered the effects of water supply shortages. The survey uncovered a large reservoir of citizen and industry support for water conservation. Trail-and-error approaches to water conservation will probably be inadequate, given the social complexity of the problem. Currently, conservation activities are viewed as a peripheral part of management responsibility and reform of management training, institutional priorities, and informational support will be required to make conservation an integral part of water resource management. (Moore-SRC)
W83-01274

MORE OR LESS WATER,
Friends of the Earth, Nelson (New Zealand).
For primary bibliographic entry see Field 6G.
W83-01317

PLANNING FOR DROUGHTS,
Metcalf and Eddy, Inc., Boston, MA.
For primary bibliographic entry see Field 6D.
W83-01347

AN INVESTIGATION OF PSYCHOLOGICAL COMPONENTS OF WATER CONSERVATION BEHAVIOR,
North Carolina State Univ. at Raleigh. Dept. of Psychology.
S. P. Gordon.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-146688, Price codes: A08 in paper copy, A01 in microfiche. PhD Thesis, 1981. 158 p, 4 Fig, 14 Tab, 73 Ref, 6 Append. OWRT B-121-NC(2). 14-34-0001-9127.

Descriptors: *Water conservation, *Behavior, *Attitudes, *North Carolina, Public opinion, Public participation, Wake County.

A model of prerequisite psychological components to water conservation behavior specifies that four sequential psychological conditions must be satisfied before conservation behavior will occur. These components are: noticing water resource cues/facts; interpreting the relationship between events in the water resource system; feeling responsible for the state of water resources; and knowing about water conservation behavior. A scale measuring each of the four predictor components and a criterion scale of conservation actions was developed. These scales were compiled in a survey instrument and administered to 302 citizens in five communities throughout the Wake County area of North Carolina. The responsibility component was found to be the strongest single predicator of conservation actions, and the notice component was a strong predictor of responsibility. This finding suggests that conservation programs should attempt to increase responsibility and that an element in this effort should be increasing awareness of water resource issues. The knowledge component was found to have a weak negative direct path to actions and indicates that teaching citizens about conservation methods will not increase conservation behavior. Although there is no direct path between interpret and action, the interpret component was found to be highly predictive of knowledge. (Moore-SRC)
W83-01363

3E. Conservation In Industry

WATER RESOURCE MANAGEMENT AND CONSERVATION FOR THE FUTURE,
North Carolina State Univ. at Raleigh. Dept. of Psychology.
For primary bibliographic entry see Field 3D.
W83-01274

3F. Conservation In Agriculture

RESPONSES TO WATER STRESS IN WHEAT AND RELATED WILD SPECIES,
Agricultural Research Organization, Bet-Dagan (Israel). Inst. of Soils and Water.
D. Shimshi, M. L. Mayoral, and D. Atsmon.
Crop Science, Vol. 22, No. 1, p 123-128, January/February 1982. 5 Fig, 28 Ref.

Descriptors: *Water stress, *Wheat, *Drought resistance, *Triticum, *Agropyrum junceum, Leaves, Water potential, Stomata, *Soil-water-plant relationships, Carbon dioxide.

Drought resistance indicators were studied in wheat (Triticum aestivum, Chinese Spring and Seeon) and three related wild species: T. longissimum, an annual growing in subhumid to semiarid habitats, mostly on sandy soils; T. kotschyi, an annual growing on the Negev Desert; and Agropyrum junceum, a littoral halophytic perennial. Potted plants subjected to water stress wilted within 5 days, except for A. junceum, which lasted up to 12 days. The following indicators of drought resistance were compared: effect of soil moisture on leaf water potential (LWP), relationship between relative water content and LWP, effect of LWP on leaf permeability, effect of LWP on CO2 fixation, and recovery following rewatering of water stressed plants. A. junceum, which proved to be the most drought resistant species in the study, was different in anatomy and morphology from the Triticum species. It maintained a constant LWP through a wide range of soil moisture depletions, and its rare of CO2 fixation remained relatively unaffected down to a LWP of -2.0 MPa. T. kotschyi almost always ranked highest, and wheat almost always lowest, in drought resistance indices. T. longissimum was intermediate. However, T. longissimum stomatal aperature recovery was faster after water stress and rewatering than T. kotschyi and wheat. (Cassar-FRC)
W83-01145

A GREENHOUSE LINE-SOURCE SPRINKLER SYSTEM FOR EVALUATING PLANT RESPONSE TO A WATER APPLICATION GRADIENT,
Utah State Univ., Logan. Crops Research Lab.
D. A. Johnson, M. D. Rumbaugh, L. S. Willardson, K. H. Asay, and D. N. Rinehart.
Crop Science, Vol 22, No 2, p 441-444, March/April, 1982. 4 Fig, 11 Ref.

Descriptors: *Sprinkler irrigation, *Irrigation design, *Greenhouses, *Alfalfa, *Water stress, Line-source sprinkler systems.

A greenhouse line-source sprinkler system for applying a uniform water gradient was designed for examining seedling response to water stress. The sprinkler chosen from among 20 variations was a Delevan spray nozzle with standard brass body, A Delevan LF2-80 degree tip, and a 50 mesh brass nozzle strainer. The transport mechanism was a steel plate equipped with 4 steel rollers. This plate was pulled along an angle iron track by a reversible gear motor, which was attached to a set of pulleys and a 0.3 cm diameter stainless steel wire rope. The nozzle, operated at 3.3 MPa pressure, traversed the length of the bed (about 5 m) in 15 min, corresponding to a maximum water application of 1.4 mm. The nozzle returned to the starting point for subsequent applications. Water application was uniform from one end of the greenhouse to the other but varied from center to outer edges. Tests on alfalfa seedlings showed that mean shoot dry weight (0.20 g at the edge to 0.34 g in the center) varied with the average daily water application (0.32 cm per day at the edge to 0.69 cm per day at the center). In the area of highest water application there was a slight decrease in mean shoot weight, indicating an excess of water at that location. (Cassar-FRC)
W83-01162

SCHEDULING IRRIGATION BY COMPUTER,
Oregon State Univ., Corvallis.
M. English.
Soil and Water, Vol 16, No 2, p 10-12, April, 1980. 1 Fig, 2 Tab.

Descriptors: *Irrigation efficiency, *Scheduling, *Computers, Planning, Water management, Erosion control, Leaching, Runoff, Irrigation, Irrigation practices, Irrigation programs, Surface runoff, Organic compounds, Farm wastes, Water pollution control.

The scientific scheduling of irrigation is considered, employing computers in combination with specially trained personnel working in the field. The field personnel use the computer to estimate soil moisture conditions from day to day. They periodically visit each field to determine the actual soil moisture content. When irrigation is called for, the field expert will consult with the farmer on the appropriate timing and the amount of water to apply. The procedure is based on principles of soil science, agronomy, meteorology and engineering. A number of benefits should be derived from such planning. The farm operator should benefit through reduced water and labor use. Important environmental benefits may also be realized. Deep percolation and the consequent leaching of salts from the soil may be reduced. Surface runoff may be reduced, and consequently the loads of fertilizers, pesticides and sediment that are carried off the fields and into receiving water will be cut back. However, it has been the experience of scheduling services in the western United States that errors in the timing and amounts of irrigation do occur. In fact, such errors have been the rule rather than the exception. Even so, the findings of both an idealized study and a study conducted under real world conditions suggest that the benefits appear to be great enough for the government agencies charged with water quality management to give consideration to such programs. (Baker-FRC)
W83-01166

IT'S ALL DOWNHILL FROM HERE. THE EREWHON RURAL WATER SUPPLY SCHEME,
For primary bibliographic entry see Field 8A.
W83-01170

CONSERVATION TILLAGE EFFECTS ON WATER CONSERVATION,
Kansas State Univ., Manhattan. Dept. of Agricultural Engineering.
J. M. Steichen, and R. W. LaForce.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-139865,

Price codes: A03 in paper copy, A01 in microfiche. Completion Report, Kansas Water Resources Research Institute, Manhattan, September 1982. 22 p, 7 Fig, 4 Tab, 13 Ref. OWRT A-098-KAN(1), 14-34-0001-0118.

Descriptors: *Kansas, Wheat, Grain sorghum, Agricultural, Rainfall-runoff, *Water conservation, *Rainfall simulator, *Infiltration, Fallow cycle, *Tillage.

A portable rainfall simulator was built and calibrated to determine effects of tillage practices on infiltration. The rainfall simulator can vary the application rate between 0.5 and 13.6 cm/h at a nozzle pressure of 41 kPa. The choice of two nozzles allows droplet size and kinetic energy similar to low intensity or high intensity rainstorms. The use of a rainfall simulator to determine rainfall-runoff properties of a soil cover complex is practical. The rainfall simulator was used as a field unit on pasture at Manhattan, Kansas and wheat ground at Colby and Hays, Kansas. Tillage practices studied are no till, stubble mulch and clean till. Tests were run at various times in the wheat fallow or wheat sorghum fallow cycle. In general the field data tend to support the estimated curve numbers obtained by reducing published curve numbers up to 10% for residue cover. Although there is some variation due to deep tillage or large cracks, these are relatively short term and would be greatly reduced by the next significant rain. It appears that runoff estimates from stubble mulched areas in northwest Kansas by reducing curve numbers for residue cover are reasonable.
W83-01240

IRRIGATION FOR CROPS IN A SUB-HUMID ENVIRONMENT, I. THE EFFECT OF IRRIGATION ON THE GROWTH AND YIELD OF SOYBEANS,
Commonwealth Scientific and Industrial Research Organization, Canberra (Australia). Div. of Plant Industry.
G. A. Constable, and A. B. Hearn.
Irrigation Science, Vol 2, No 1, p 1-12, 1980. 5 Fig, 2 Tab, 18 Ref.

Descriptors: *Irrigation practices, *Crop yield, Farming, Water supply, Water demand, Vegetation, *Soybeans, Evapotranspiration, Water conservation.

Six irrigation treatments were imposed on two soybean cultivars grown on a grey cracking clay soil in two successive seasons. Irrigation treatments were Frequent (FF) - irrigation after 90 mm of calculated evapotranspiration (or 40% depletion of available moisture), Moderate (MM) - after 135 mm (60%), or Infrequent (II) - after 180 mm (80%) and NIL (rainfed). Two additional treatments, FM and MF, combined different irrigation frequencies before and after mid-flowering. Irrigation treatment II and NIL had less leaf area and total dry weight, but the distribution of dry weight between leaves, stems and pods was identical for all irrigation treatments in both seasons within a cultivar. It was found that net assimilation rate on a unit leaf area basis was less affected by irrigation treatment than was leaf expansion. Treatment FM had the greatest apparent redistribution of dry weight from leaves and stems to pods. Frequent irrigation during late flowering and pod filling was needed to ensure maximum yield in all seasons. It was concluded that one or two fewer irrigations could be applied during the vegetative phase than is the present commercial practice, and the water saved could be used to grow a larger area of crop. (Baker-FRC)
W83-01288

MOISTURE STRESS IN NAVY BEANS. I. EFFECT OF WITHHOLDING IRRIGATION AT DIFFERENT PHENOLOGICAL STAGES ON GROWTH AND YIELD,
Queensland Dept. of Primary Industries, Warwick (Australia).
J. L. Gunton, and J. P. Evenson.
Irrigation Science, Vol 2, No 1, p 49-58, 1980. 3 Fig, 5 Tab, 22 Ref.

Descriptors: *Moisture stress, *Crop yield, *Irrigation practices, Frosts, *Navy beans, Water supply, Moisture availability.

The effect of plant water stress imposed at all combinations of the three main phenological stages on the yield and growth of Navy beans was studied in field experiments at the Inglewood irrigation area of Queensland during the summers of 1971 and 1972. In 1972, a short, mild growing season with early frosts, yields varied with treatment from 0.55 to 1.52 t/ha. In 1972, a hotter growing season especially during the preflower stage but of normal duration, yields varied from 1.12 to 2.27 t/ha. Moisture stress imposed in the preflower and flowering stages in 1971 reduced yields by 28% and 24%, respectively. In 1972 moisture stress during the preflower stage reduced yield by 37% only if irrigation was also with held during the flowering stage. Moisture stress imposed during the flowering stage in 1972 reduced yields by 40%. Evaluation of the effects of moisture stress during the pod development stage was not possible due to early frosts in 1971 and rainfall in 1972. Yields were almost equally highly correlated with leaf area index and leaf area duration. Crop growth rate was similarly correlated with leaf area index. (Baker-FRC)
W83-01289

COMPUTER EVALUATION OF SPRINKLER IRRIGATION UNIFORMITY,
Kagoshima Univ. (Japan). Faculty of Engineering.
Y. Fukui, K. Nakanishi, and S. Okamura.
Irrigation Science, Vol 2, No 1, p 23-32, 1980. 11 Fig, 1 Tab, 5 Ref.

Descriptors: *Irrigation patterns, Evaluation, *Model studies, Irrigation, Water supply, Computers, Wind, *Sprinkler irrigation, Sprinklers, Sprinkling, Nozzles.

A method for evaluating the water application rate (WAR) and uniformity coefficient (Cu) of overlapping irrigation sprinklers is given for realistic field conditions, which include wind drift of the sprinkler spray. The method requires as input the geometry of the sprinkler arrangement, trajectories of water drops from the sprinkler nozzle as calculated by the equations of motion, and the WAR distribution (discharge) profile of a single sprinkler experimentally observed under windless conditions. Wind direction with respect to the main sprinkler line has a small effect on Cu and is assumed to be parallel to the main line. Results indicate that the wind drift effect of sprinkler spray on Cu can be neglected for wind velocities less than 1 m/sec. Analysis of simulated discharge profiles shows that the maximum value of the uniformity coefficient was obtained with triangular sprinkler discharge profiles at low values of spacing, changing to trapezoidal profiles as the spacing increases. The effect of nozzle pressure on WAR was evaluated for the pressure range between 294 and 490 kPa, and an optimum layout of overlapping sprinklers, designed to minimize the effect of wind drift and nozzle pressure on the uniformity of WAR distribution andCu to be calculated for sprinkler irrigation systems operating under practical operating conditions involving wind drift of sprays. (Baker-FRC)
W83-01290

IRRIGATION FOR CROPS IN A SUB-HUMID ENVIRONMENT, II. THE WATER REQUIREMENTS OF SOYBEANS,
University of New England, Armidale (Australia). Dept. of Agronomy and Soil Science.
For primary bibliographic entry see Field 2I.
W83-01314

4. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control Of Water On The Surface

INFLOW AND LEVELS OF THE CASPIAN SEA AND THEIR VARIATIONS UNDER THE EFFECT OF CLIMATIC FACTORS AND ECONOMIC ACTIVITY,
I. A. Shiklomanov, and V. Yu. Georgievskii.
Water Resources, Vol 8, No 5, p 465-476, September-October, 1981. 5 Fig, 2 Tab, 16 Ref. Translated from Vodnye Resursy, No 5, p 5-19, September-October, 1981.

Descriptors: *Economic development, *Mathematical models, *Water level fluctuations, *Long-term planning, *Sea level, *Dam effects, Mathematical models, Model studies, Evaluation, Coastal zone management, Future planning, Benefits, Projections, Seasonal variation, Surface runoff, *Caspian Sea.

A quantitative study was carried out of the changes in annual and seasonal runoff under the influence of economic activity of the main rivers emptying into the Caspian Sea. The normal inflow of river waters to the sea in 1880-1977 was 298 cu km/yr, with the effects of economic activity making the actual amount about 288 cu km/yr. The drop in sea level in the basin due to anthropogenic factors during 1932-1977 was about 1.4 meters. Because substantiated long range climatic predictions of sea level variations were not possible to make, a probabilistic variant calculation based on modeled series of the water-balance components of the sea was used to determine future sea level positions. Use of mathematical models showed that damming the Kara-Bogaz-Gol Gulf will help to maintain the sea level, as will diverting part of the runoff of northern rivers to the Volga. The maximum annual subsidies to the sea required in individual years to maintain the Caspian not below the -29.5 m mark may exceed 100 cu km. With additional water delivery of a maximum of 60 cu km/yr starting in 1991, it is estimated that future possible temporary decreases of the level below -29.5 m will last not more than 2 yr. (Geiger-FRC)
W83-01094

FENCES FOR FLOODWAYS,
Manawatu Catchment Board (New Zealand).
M. K. Holland.
Soil and Water, Vol. 16, No. 2, p 29-30, April, 1980. 3 Fig.

Descriptors: *Flood damage, *Fences, Construction, Maintenance, Flood protection, *New Zealand.

Collapsible fencing for berm lands is described. Of the many collapsible fences tried under flood conditions, two types have been collapsed and re-erected on numerous occasions and should give better than 15-20 years' life without too much maintenance. The collapsible fence Mark 1, which comes highly recommended, uses posts placed 14-16 m apart, 5-6 12.5 gauge high tensile wires, barb top and bottom, chain battens at 1.80 m centers and, where necessary, chains used as foot posts in dips. For erection, the top and bottom barbs are used as guide wires. While this procedure is unconventional and slower, it is necessary. A full 200 meters of fencing (about 15 posts) can be lowered in 10-15 minutes. A heavier fence is also described. (Baker-FRC)
W83-01148

ASWAN - DAM AND BE DAMNED.
Soil and Water, Vol 17, No 1, p 4-7, February, 1981. 4 Fig.

Descriptors: *Dams, *Environmental effects, *Farming, Nutrients, Irrigation, Nile River, Irriga-

tion canals, Canals, Aswan Dam, *Egypt, Leaching, Soil types, Clay.

The construction of the Dam at Aswan has brought about many changes in the quality and techniques used in farming in those areas, which formerly depended on mud and nutrients delivered yearly as the Nile flooded its banks. The area is now almost exclusively dependent on artificial fertilizers and ranks as one of the world's largest consumers in this market. The chemical fertilizer residues remain in the soil, causing a buildup of salinity, under conditions where the growing of highly demanding crops in rapid succession has already resulted in the soil becoming increasingly infertile. The soil is also gradually becoming clay-like and impervious. Recently, attempts have been made to carry out underground drainage. The reservoir created by the dam has an evaporation rate far greater than expected. There is also a problem with overgrowth of water hyacinths, huge numbers of water snakes, and abundance of snails which serve as hosts for flukes producing bilharzia in humans. On the positive side of the picture, agricultural production has almost doubled. Plans are being made to prepare a mud channel from the south end of the reservoir to below the old dam which will by-pass the high dam and convey the mud into the Nile once again. (Baker-FRC)
W83-01156

GRASS CARP AND WATER WEED,
Ministry of Agriculture and Fisheries (England). Fisheries Research Lab.
C. Mitchell.
Soil and Water, Vol 17, No 2, p 22-26, April, 1981. 1 Fig, 2 Ref.

Descriptors: *Aquatic weed control *Fish, Water quality, Reservoirs, Lakes, Stagnant water, *Grass carp, Carp, Weed control, Water supply development. *New Zealand.

Use of the herbivorous fish, the Chinese grass carp, to control water weeds has been investigated in static bodies of water at two sites, both isolated from other fresh waters. The study commenced in 1975. One site was the Waihi Beach Reservoir, with an area of 1.92 ha and a volume of about 40,000 cubic meters. The second trial site was Parkinsons's Lake, a eutrophic, 1.92 ha sand dune lake with an inflow from one temporary stream and direct runoff from the surrounding pasture. Findings indicated that populations of grass carp weighing more than 2 kg each are capable of virtually eliminating aquatic plant populations in static water under New Zealand conditions. The retention of some aquatic plant cover is desired to protect water quality and provide cover for fish and water fowl populations. Stocking densities will need to be adjusted so that optimum levels of weed control are attained. (Baker-FRC)
W83-01173

MAGNITUDE AND FREQUENCY OF FLOODS FROM SELECTED DRAINAGE BASINS IN SOUTH DAKOTA,
Geological Survey, Huron, SD. Water Resources Div.
L. D. Becker.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-237470, Price codes: A05 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 82-31, 1982. 90 p, 5 Fig, 4 Tab, 32 Ref.

Descriptors: *Floods, *Flood frequency, *Flood recurrence interval, *Flood peak, Flood forecasting, Surface water, Streamflow, Rainfall-runoff relationships, Gaging stations, Flood data, *South Dakota.

The 2-, 5-, 10-, 25-, 50-, and 100-year floods are determined for gaged sites on 120 selected, small drainage basins in South Dakota. These estimates are from the frequency curves defined from the streamflow records. Short-term records for 66 sites were extended on the basis of long-term climatic records and a rainfall-runoff model. These frequency curves may provide the best estimates of floods at these gaged sites. Analyses of flood-frequency information from these gaged sites have been the basis for techniques (published previously) used in estimating flood magnitude and frequency at ungaged sites in South Dakota. This report supplements flood-frequency information published earlier. It presents: Annual peak discharges colected during a 25-year period at 124 crest-stage partial-record stations; maximum observed and unit discharges determined for 124 crest-stage and 120 continuous-record gaging stations; updated flood-frequency curves for 120 crest-stage gages; a documentation of analytical procedures used; and a summary of the small-streams flood-peak data collection program in the State from 1955 to 1981. Maximum flood peaks determined at 244 partial- and continuous-record gaging stations and at 52 miscellaneous sites are compared with regional flood relationships. (USGS)
W83-01193

MODERNIZING IRRIGATION SYSTEMS IN ALBERTA,
Department of the Environment, Edmonton (Alberta). Div. of Design and Construction.
J. W. Thiessen, and R. F. Smith.
Canadian Journal of Civil Engineering, Vol. 9, No. 2, p 323-337, June, 1982. 11 Fig, 7 Tab, 19 Ref.

Descriptors: *Irrigation projects, *Regional development, *Semiarid lands, Water supply development, Water demands, *Alberta, Canada, Agriculture, Water resources development, *Irrigation systems.

Canadian experience in irrigation in the Province of Alberta is outlined, including the policies, procedures, and objectives that have been adopted to handle the financing and administration of a cost-sharing program designed to rehabilitate and expand the existing irrigation systems. Moisture is the limiting factor to crop production in Alberta. The history of irrigation in the area is described, along with methods of administration and cost-sharing arrangements. Operation and maintenance of irrigation distribution systems are considered, stressing capital works rehabilitation, improved layout of the system, conveyance efficiencies, technical guidelines, and irrigation expansion. Seepage control in irrigation canals is discussed, including buried membrane lining, concrete lining, interceptor drains, buried pipe systems, and other means of seepage control. Irrigation farming practices and river basin planning are discussed. Irrigation is the largest single water use in Southern Alberta; competition now exists for the limited water supply. Potentially irrigable land far exceeds the potential supply of water, and shortages occur during periods of low runoff or high demand. Planning studies call for the development of new storage facilities, upgrading existing distribution systems, and more efficient use of water. Great increases in development of irrigated agriculture could only occur with transfer of water from outside the basin. (Baker-FRC)
W83-01232

PASSAGE OF FLOODS OVER RIVER FLOODPLAINS,
For primary bibliographic entry see Field 2E.
W83-01233

SOLVING A DRAINAGE DITCH VEGETATION PROBLEM.
Public Works, Vol 113, No 9, p 84-85, September, 1982.

Descriptors: *Herbicides, *Drainage ditches, *Vegetation, Krenite, Hyvar XL, Drainage systems, Drainage canals, Clinton County, *Michigan, Maintenance, Weed control, Water management.

Control of woody vegetation clogging drainage canals in Clinton County, Michigan, features Krenite sprayed from a Ditch-Trol rig in late summer or early fall. The spray rig can treat up to 3 miles of dense brush in a day. This herbicide is registered for use on noncropland areas, including land adjacent to water bodies. Followup spot-gun treatments with Hyvar XL liquid controls resprouting stumps or escapes from previous treatments. The drainage system reconstruction began after a severe ice storm clogged the canals with fallen trees and brush. After accumulated debris and overgrowth were removed, the brush control program was established. In 1981 50 miles of the county's 800 miles of ditches were treated with Krenite or other suitable herbicides. (Cassar-FRC)
W83-01332

DRAINAGE IS THE BYWORD IN LOUISIANA PARISH.
Public Works, Vol 113, No 9, p 72-73, September, 1982.

Descriptors: *Drainage programs, *Water management, *Land reclamation, St. James Parish, *Louisiana, Drainage canals, Drainage ditches, Drainage engineering, Drainage networks, Drainage systems, Open-channel drainage.

In 1977 St. James Parish, Louisiana, launched a major drainage construction program which has resulted in over 100 miles of drainage structures, converting 6000 acres of swamp to farm and industrial sites. In-house construction crews are used whenever possible. Contractors are used for projects requiring unusually large equipment or when parish crews are unavailable. The drainage program for this flat, low-level gumbo mud area began with construction of 90 ft cross-section channels around the rim of the parish. Next, smaller primary and secondary ditches were dug to move the water to the largest channels. A maintenance program is aimed at keeping water in the large canals to prevent erosion and removing vegetation from smaller canals to prevent blockage. (Cassar-FRC)
W83-01348

4B. Groundwater Management

APPLICATION OF STATISTICAL METHODS TO FORECASTING OF NATURAL GROUNDWATER TABLES,
Morton and Partners Ltd., Rexdale (Ontario).
E. Zaltsberg.
Canadian Journal of Earth Sciences, Vol 19, No 7, p 1486-1491, July, 1982. 3 Fig, 3 Tab, 12 Ref.

Descriptors: *Forecasting, *Groundwater level, *Water table, *Statistical methods, Mathematical equations, Model studies, Drainage, Lithology, Saturation zone, Seasonal variations, Water supply, Water resources development.

Several statistical methods that can be used for forecasting the groundwater table regime are described. The choice of the method depends on: duration of observation period; hydrogeological conditions, especially degree of drainage and lithological contents of vadose and saturated zones; and duration of the lead period. In every case the least complicated forecasting equation with the minimum number of coefficients is the most reliable, especially for relatively short observation periods. It is noted that some of the methods described may be successfully used not only for forecasting but also for lengthening the groundwater observation period. (Baker-FRC)
W83-01108

A PRICING POLICY FOR GROUNDWATER MANAGEMENT IN PUERTO RICO,
Puerto Rico Univ., Mayaguez. Water Resources Research Inst.
For primary bibliographic entry see Field 6C.
W83-01276

MUNICIPAL FRACTURED-ROCK WELLS,
For primary bibliographic entry see Field 3B.
W83-01350

NETWORK MODEL FOR OPTIMAL MANAGEMENT OF STREAM-AQUIFER SYSTEMS,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
S. Phamwon.

Available from the National Technical Information Service, Springfield, VA 22161 as PB83-146712, Price codes: A13 in paper copy, A01 in microfiche. PhD Thesis, 1982. 282 p, 37 Ref, 7 Tab, 76 Ref, 13 Append. OWRT B-201-COLO(4).

Descriptors: *Computer models, *Conjunctive use, *Aquifer management, *Hydrologic models, *Priorities, *Artificial recharge, Model studies, Water allocation, Return flow, Evapotranspiration, Groundwater storage, Surface storage, Water rights, Water management, *Colorado.

A computer model is presented for management of the conjunctive use of surface and subsurface storage in an interconnected stream-aquifer system. The model simultaneously stimulates the hydrologic system and optimizes the water allocation period by period. The model includes simulation of groundwater flow, subsurface storage, recharge and potential evapotranspiration. In order to demonstrate the usefulness of the model, a case study of the South Platte River section from the North Sterling inlet canal to the Julesburg gaging station in eastern Colorado was selected. The calibration results of the return flows to the river from several sources were satisfactory for the dry to average years but were less satisfactory for the wet years. The priorities of various demands obtained from the calibration were the same as the relative ranking of water rights of those demands. Two management alternatives were investigated. The first alternative considered artificial recharge to subsurface storage in addition to the current practices of the system. With this alternative, water is spread over areas chosen for artificial recharge areas during non-irrigation season months. With proper artificial recharge, it is unlikely that subsurface storage would be severely depleted due to heavy groundwater pumping during drought periods. The second groundwater management alternative studied the impact of changing downstream flow requirements governed by interstate compact agreement between Colorado and Nebraska. The results indicated that for the dry and average year conditions, any increase in the downstream flow would cause shortages in Colorado. (Moore-SRC)
W83-01366

4C. Effects On Water Of Man's Non-Water Activities

WOOD AND WATER,
For primary bibliographic entry see Field 6D.
W83-01171

STREAMFLOW AND WATER-QUALITY CONDITIONS, WILSONS CREEK AND JAMES RIVER, SPRINGFIELD AREA, MISSOURI,
Geological Survey, Rolla, MO. Water Resources Div.
W. R. Berkas.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-226218, Price codes: A03 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 82-26, April, 1982. 38 p, 16 Fig, 11 Ref.

Descriptors: *Streamflow, *Water quality, *Urban runoff, *Effluents, Municipal wastes, Surface water, Water pollution effects, Water pollution sources, *Missouri, Springfield, Wilsons Creek, James River.

A network of water-quality monitoring stations was established upstream and downstream from the Southwest Wastewater-Treatment Plant on Wilsons Creek to monitor the effects of sewage effluent on water quality. Data indicate that 82 percent of the time the flow in Wilsons Creek upstream from thee wastewater-treatment plant is less than the effluent discharged from the plant. On October 15, 1977, an advanced wastewater-treatment facility was put into operation. Of the four water-quality indicators measured at the monitoring stations (specific conductance, dissolved oxygen, pH, and water temperature), only dissolved oxygen showed improvement downstream from the plant. During urban runoff, the specific conductance momentarily increased and dissolved-oxygen, concentration momentarily decreased in Wilsons Creek upstream from the plant. Urban runoff was found to have no effect on specific conductance and dissolved oxygen downstream from the plant before or after the addition of the advanced wastewater-treatment facility. Data and collected monthly from the James River showed that the dissolved-oxygen concentrations and the total nitrite plus nitrate nitrogen concentrations increased, whereas the dissolved-manganese concentrations decreased after the advanced wastewater-treatment facility was implemented. (USGS)
W83-01192

4D. Watershed Protection

PREVENTING EROSION, LANDSLIP AND FLOODING, A PLANNING APPROACH,
Ministry of Works and Development (New Zealand).
For primary bibliographic entry see Field 6F.
W83-01147

THE TE AWA RESEARCH: 35 YEARS OF SOIL CONSERVATION,
F. E. T. Suckling.
Soil and Water, Vol 16, No 5, p 16-20, October, 1980. 17 Fig.

Descriptors: *Soil conservation, *Flood control, *Erosion control, Rainfall, Vegetation establishment, Te Awa, Catchment areas, *New Zealand, Dams, Gully erosion, Gullies, Ravines.

Early research on soil conservation conducted on a hill country farm 30 km north of Palmerston North (New Zealand) is reviewed 35 years later. In 1945 the Soil Conservation and Rivers Control Council leased an area of hill country for soil conservation studies. Gully control experiments were based on debris dam construction techniques, but with the use of live poles. The great weakness and danger evident in the structures of the dams appeared to be scouring on this easily eroded soil. After an unusually heavy storm in 1949, a second approach was tried. This alternative appeared to be either soundly engineered concrete structures, where the energy of the water is dissipated by mechanical an structural devices, or a process of new gully alignment using bulldozers to restore the broad grassed runways which existed before the gullies washed out. The plan was made to flatten out the gully floor with a bulldozer to form a broad U and then grass it over. In spite of heavy seeding, topdressing and favorable weather conditions, establishment was poor and growth slow. A concrete spillway was eventually constructed in 1945. Mass tree plantings each winter began to take effect from 1949 onwards. Over the years grassland improvement has proved to be the most successful aspect of the work at Te Awa. (Baker-FRC)
W83-01169

EROSION, REDEPOSITION, AND DELIVERY OF SEDIMENT TO MIDWESTERN STREAMS,
Arizona Univ., Tucson. School of Renewable Natural Resources.
D. C. Wilkin, and S. J. Hebel.
Water Resources Research, Vol 18, No 4, p 1278-1282, August, 1982. 2 Tab, 17 Ref.

Descriptors: *Erosion control, *Sediment transport, *Floodplains, Cropping, Vegetation, Watersheds, Sediments, Sedimentation, Streams, Water quality, Watershed management, *Illinois, Middleforks River, Forest watersheds.

Sediment movement patterns were studied in a midwestern watershed using fallout cesium-137 techniques. The data obtained were insufficient to give any clear indication of sediment delivery ratios to be expected from the various upland landscape positions. The little evidence gathered indicates that much of the erosion is intercepted by upland depressions, grassed field borders, fencelines, hedgerows, and roadside ditches. Far more upland sampling will need to be done in areas with differing topography, soils, and cropping systems. Cropped borderlands which were isolated from the floodplains by wooded areas, while eroding at high rates, seemed to be delivering sediment to the active floodplain at an attenuated rate, depending on the width of the intervening woodland. the contribution of floodplains to the sediment problems depends distincly on management. Likewise, the steep borderlands adjoining the floodplains, if not cropped, not only erode at excessive rates but deliver virtually all such erosion to the active floodplain unless a forested buffer intervenes. (Baker-FRC)
W83-01203

SOIL CONSERVATION PROTECTS THE TROUT,
Waikato Valley Authority, Hamilton (New Zealand).
K. Young.
Soil and Water, Vol 16, No 3, p 7-8, June, 1980. 1 Fig.

Descriptors: *Fish, *Soil conservation, *Erosion control, Catchment areas, Conservation, Lake Taupo, Waikato Valley, Whangamata Catchment, *New Zealand, Trees, Stream banks.

The Waikato Valley Authority (New Zealand) was approached by landowners and by the Department of Internal Affairs with a view to formulating a proposal for conservation works in the Lake Taupo and Whangamata catchment areas. Work began in February of 1976 to reduce rising sediment loads by controlling the various types of erosion within the catchment, revitalizing the stream as a trout spawning habitat, enhancing birdlife within retired areas, assisting farm management, and protecting land and water resources within this area in perpetuity. In 1961, before land development and consequent erosion took place, a fish trap was placed in the Whangamata Stream; total run figures for the period 1 June to 7 September were 2049. A similar trap was installed in 1979, with a total run of 3258 trout. Unofficial estimates indicate that for the spawning period of 1975 there might have been fewer than 80 spawning trout. In the process of mitigating sediment loads and controlling erosion in this catchment, trout spawning has been revitalized, birdlife habitats are enhanced, farm management has benefited, and the land and water resources have been protected. (Baker-FRC)
W83-01294

5. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification Of Pollutants

EXTRACTABLE ORGANIC MATTER IN MUNICIPAL WASTEWATERS. 2. HYDROCARBONS: MOLECULAR CHARACTERIZATION,
California Univ., Los Angeles. Dept. of Earth and Space Sciences.
R. P. Eganhouse, and I. R. Kaplan.
Environmental Science and Technology, Vol 16, No 9, p 541-551, 1982. 7 Fig, 2 Tab, 59 Ref.

Descriptors: *Water analysis, *Municipal wastewater, *Organic compounds, Petroleum industry, Oils, Leaching, Infiltration, Fate of pollutants, Path of pollutants, Environmental effects.

High-resolution gas chromatography and computer assisted gas chromatography-mass spectrometry were used to analyze hydrocarbons isolated from southern California municipal wastewaters. Most of the hydrocarbons, 56-77%, were not chromatographically resolvable and probably derive from petroleum products such as lubricating oils. Normal, iso-, and acyclic isoprenoid alkanes along with alkylcyclohexanes and numerous series of substituted benzenes and polycyclic aromatic hydrocarbons compose the major fraction of the resolvable hydrocarbons. Polycyclic terpenoids occur as trace constituents and appear to be of ancient origin. Locally produced petroleum was, at most, only a minor contributor to these

wastewaters. A homologous series of long-chain alkylbenzenes presumably derived from the LAS-type detergents was identified. These compounds seem abundant and ubiquitous domestic wastewater constituents that may be exploited as anthropogenic waste tracers in the marine environment. (Baker-FRC)
W83-01077

ON THE USE OF THE NEPHELOMETER IN ESTUARINE WATERS,
Johns Hopkins Univ., Baltimore, MD. Chesapeake Bay Inst.
A. Eaton, V. Grant, O. Bricker, and D. Wells.
Estuaries, Vol. 4, No. 4, p 379-384, December, 1981. 4 Fig, 2 Tab, 21 Ref.

Descriptors: *Estuaries, *Suspended sediments, *Sampling, *Pollutant identification, *Nephelometer, Turbidity, *Chesapeake Bay, Particle size.

A guide for sampling suspended sediments at vertical profiles in an estuary featuring nephelometer readings is described. Data was obtained during two Chesapeake Bay cruises in 1979. Two generalizations were apparent from the results. Variations in nephelometer responses were much greater between stations than within stations, with higher load/response ratios near the upper estuary than in the lower estuary. Within a given station there were systematic variations in the ratio, with bottom samples having higher ratios than surface samples. Coulter Counter determination of particle sizes confirmed that load/response ratios reflected changes in particle size, allowing a separation of different sources of sediment load such as fines in a background load and coarser material present intermittently. A sampling procedure which decreases filtration requirements by a factor of 2 is described. First a water sample for filtration (calibration) and a nephelometer reading are taken near the bottom. Nephelometer readings are taken through the water column. Whenever readings change by 10-15%, another calibration is done. The ratio of load in mg per liter to nephelomter readings is tabulated for all calibrated samples, and weights between calibration points are interpolated. (Cassar-FRC)
W83-01135

CHEMICAL STUDIES OF COPPER-ORGANIC COMPLEXES ISOLATED FROM ESTUARINE WATERS USING C18 REVERSE-PHASE LIQUID CHROMATOGRAPHY,
Rhode Island Univ., Kingston, Graduate School of Oceanography.
G. L. Mills, A. K. Hanson, Jr, J. G. Quinn, W. R. Lammela, and N. D. Chasteen.
Marine Chemistry, Vol. 11, No. 4, p 355-377, 1982. 6 Fig, 5 Tab, 30 Ref.

Descriptors: *Copper, *Organic matter, *Chelation, *Pollutant identification, *Narragansett Bay, *Rhode Island, *Chromatography, Chemical reactions, Seawater.

Reverse-phase liquid chromatography with C18 Sep-Pak cartridges was used for isolating dissolved organic matter (DOM) and dissolved copper-organic complexes from estuarine waters of Narragansett Bay, Rhode Island. The cartridges retained organic matter and Cu with constant efficiency from samples up to about 1 liter in volume. The isolated materials were eluted from the column with water; methanol mixtures of increasing methanol proportions to obtain six fractions. The 70:30 water: methanol mixture produced one fraction of organic matter with copper activity 6 times greater than the overall activity for the DOM. Chromatographic analysis of this fraction indicated an intermediate polarity and appreciable aromatic character. Other investigations showed that most of the Cu was associated with acidic sites on the DOM and that the binding sites probably involved oxygen donor ligands. Ultraviolet radiation of seawater for 6 hours destroyed 77% of the Cu-organic complexes but only 37% of the DOM. Studies of the exchange of Cu64 with the binding sites indicated that 70% of the sites readily exchanged with copper in seawater and 20% of the sites were essentially inert to exchange. (Cassar-FRC)
W83-01139

ANIONIC SURFACTANT CONCENTRATION IN THE RIVER AND SEA WATERS OF HYOGO PREF. AND ITS RELATIONSHIP TO PHOSPHORUS CONCENTRATION, (IN JAPANESE),
Hyogo Prefecture Environmental Science Inst., Kobe (Japan).
For primary bibliographic entry see Field 5B.
W83-01152

GROUND WATER GEOCHEMISTRY OF 228RA, 226RA, AND 222RN,
South Carolina Univ., Columbia. Dept. of Geology.
P. T. King, J. Michel, and W. S. Moore.
Geochimica et Cosmochimica Acta, Vol 46, No 7, p 1173-1182, July, 1982. 5 Fig, 3 Tab, 21 Ref. OWRT B-127-SC.

Descriptors: *Groundwater, *Geochemistry, *Radium, *Radon, Thorium, Uranium, *South Carolina, Radioisotopes, Water analysis, Chemical analysis, Chemical reactions.

The distribution of two intermediate nuclides of the U-228 decay series, RA-226 and Rn-222 and the immediate daughter of Th-232, Ra-228, was investigated in the ground water of South Carolina. Over 150 groundwater samples were collected from drilled, public water supply wells. A wide range of aquifer lithologies was sampled, including the crystalline rocks of the Piedmont and sedimentary deposits of the Coatal Plain. A significant linear relation was noted between log Ra-228 and log Ra-226 in the Piedmont and Coastal Plain ground waters. Median Ra-228/Ra-226 activity ratios for the Piedmont, 1.2, and Coastal Plain, 1.3, groundwater were close to estimated average crustal Th-232/U-238 activity ratios of 1.2 to 1.5 corresponding to Th/U weight ratios of 3.5 to 4.5. A linear correlation was also noted between log Rn-222 and long Ra-226 for Piedmont and Coastal Plain groundwater. However, the median Rn-222/Ra-226 activity ratio for Piedmont groundwater, 6100, was much higher than for Coastal Plain groundwater, 230. Higher excess Rn-222 activities may be due to greater retention of Ra-226 by the chemically active Piedmont aquifers compared to the more inert sand aquifers sampled in the Coastal Plain. The relationship between log Ra-228 and log Ra-226 was used to predict total Ra distributions in Appalachian and Atlantic and Gulf Coastal Plain groundwater. Predictions estimate that 2.4% of Appalachian and 5.3% of Atlantic and Gulf Coastal Plain groundwater supplies contain total Ra activities in excess of the 5 pCi/liter limit established by the US EPA. These predictions also indicate that 40-50% of these groundwater wells may be overlooked using the presently suggested screening activity of 3.0 pCi/liter of Ra-226 for Ra-228 analysis. (Baker-FRC)
W83-01157

EVALUATION OF A PERSULFATE DIGESTION METHOD FOR PARTICULATE NITROGEN AND PHOSPHORUS,
Georgia Univ., Athens, Inst. of Ecology.
C. L. Langner, and P. F. Hendrix.
Water Research, Vol 16, No 10, p 1451-1454, October, 1982. 3 Tab, 19 Ref.

Descriptors: *Water analysis, *Nutrients, *Digestion, *Persulfates, *Phosphorus, *Nitrogen, Particulates, Natural waters, Leaves, Digestion method, Pollutant identification, Periphyton.

A persulfate digestion method for particulate nitrogen and phosphorus in aufwuchs suspensions was tested on two types of dried materials and samples from a freshwater microcosm. The dried materials included orchard leaves and aufwuchs. Recoveries ranged from 80-100%, depending on the reference material composition, and coefficients of variation were from 1.3 to 26.8% for nitrogen and 0.3 to 9.3% for phosphorus. The maximum recovery of both nitrogen and phosphorus from the aufwuchs material occurred in samples containing 300-400 mg persulfate. This suggests an optimum persulfate to sample weight ratio of about 200-250 for the conditions used in this study. The ease of the persulfate digestion is a major advantage over the Kjeldahl procedure. The method is at least as efficient as the analytical procedures to which it has been compared. However, it is noted that sizable internal stores of nitrate-nitrogen in algal tissue would result in higher nitrogen values for persulfate compared to Kjeldahl. Therefore, unless corrections can be made, this value should be considered as representing total nitrogen rather than total organic nitrogen. (Baker-FRC)
W83-01196

EFFECT OF CONTAINER TYPE ON PH AND ALKALINITY STABILITY,
Municipal Environmental Research Lab., Cincinnati, OH.
M. R. Schock, and S. C. Schock.
Water Research, Vol 16, No 10, p 1455-1464, October, 1982. 10 Fig, 6 Tab, 17 Ref.

Descriptors: *Water analysis, *Sample preservation, Water sampling, Preservation, Sampling, *Alkalinity, Acidity, *Hydrogen ion concentration, Pollutant identification.

Efforts were made to develop a simple, inexpensive methodology which can adequately preserve the pH and alkalinity of samples for a long enough period of time to allow substitution of analytical values obtained in a laboratory for those that otherwise would have to be obtained by field personnel. Several container and cap combinations were evaluated for their ability to preserve the pH and alkalinity of test waters that were out of equilibrium with atmospheric carbon dioxide over time periods representative of mail or other surface transport. Provided that no air bubbles were present when the sample bottle was filled and sealed, polyvinyl chloride bottles with caps having a conical polyethylene insert yielded the most satisfactory results. High density linear polyethylene bottles were also generally satisfactory. Cap design was noted to be very important. Guidelines for analysis and preservation are given and, if they are followed, laboratory measurements can be reliably substituted for field measurements in many instances. (Baker-FRC)
W83-01197

DETERMINATION OF TOTAL KJELDAHL NITROGEN AND TOTAL PHOSPHORUS IN SURFACE WATERS AND WASTEWATERS,
Wisconsin State Lab. of Hygiene, Madison.
G. T. Bowman, and J. J. Delfino.
Journal of the Water Pollution Control Federation, Vol 54, No 9, p 1324-1330, September, 1982. 14 Tab, 16 Ref.

Descriptors: *Water analysis, *Nitrogen, *Phosphorus, Wastewaters, Natural waters, Rivers, Lakes, *Kjeldahl nitrogen, Nutrients, Spectrophotometry, Automation, *Pollution identification.

The Wisconsin State Laboratory of Hygiene technique for determining total Kjeldahl nitrogen and total phosphorus in surface and waste waters is described, and a comprehensive evaluation of data obtained over three years of routine use is presented. By modifying certain procedural details employed in a previously presented method, the present technique allows considerably increased routine sample analytical capacity compared with manual methods. Increased precision is also noted for both the TKN and P semiautomated procedures, whereas improved accuracy (recovery) is noted for TKN measurements using nicotinic acid as a standard. The digestion procedure was modified by adding an additional BD40 block digestor, increasing the maximum sample volume from 10to 20 ml, increasing the digestion temperature from 370 to 380 C, and increasing the digestion time at 380 C from 30 to 75 min. (Baker-FRC)
W83-01210

TIME-DEPENDENT VARIATION OF MERCURY IN A STREAM SEDIMENT AND THE

EFFECT UPON MERCURY CONTENT IN GAMMARUS PULEX (L.),
Aarhus Univ. (Denmark). Zoologisk Inst.
P. Kristensen.
Water Research, Vol 16, No 6, p 759-764, June, 1982. 6 Fig, 2 Tab, 20 Ref.

Descriptors: *Mercury, *Bottom sediments, Sediments, *Amphipods, *Gammarus, Variability, *Organic matter, Water pollution effects, Pollutant identification.

The objectives of this study were to investigate the variability of mercury as related to the variation of organic matter in the sediment and to investigate a possible relation between content of mercury in Gammarus pulex (L.) and the sediment. An investigation was carried out over the three months in a stream environment. A positive correlation was noted between the organic content and the mercury content of the sediment samples. The mean mercury concentration in the organic fraction can be read from the regression line. During the study period a very high fluctuation was found in the mercury content of analyzed Gammarus pulex. The phenomenon may be explained through fluctuations in the methylating processes within the sediment. No positive correlation was found between mercury in Gammarus pulex and in sediment samples taken from identical locations. (Baker-FRC)
W83-01212

USE AND LIMITATIONS OF SEDIMENTARY PIGMENTS AS INDICATORS OF PAST LAKE PRODUCTIVITY,
Massachusetts Univ., Amherst. Dept. of Zoology.
S. D. Ludlam.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-139683, Price codes: A04 in paper copy, A01 in microfiche. Publication No 127, Water Resources Research Center, University of Massachusetts, Amherst, June, 1982. 63 p, 6 Fig, 7 Tab, 43 Ref. OWRT B-068-MASS(1), 14-34-0001-9117.

Descriptors: Limnology, *Lake Morphology, *Eutrophication, *Aquatic productivity, *Lake sediments, Sediments, Pollution load, Lake Basins, Life history studies, *Massachusetts, Lakes.

The horizontal distribution of sedimentary pigments was investigated in 6 Massachusetts lakes, 4 in the Berkshire Hills and 2 on Cape Cod. The concentration of sedimentary chlorophyll and carotenoids in the most surficial sediment was directly related to sestonic chlorophyll a, water depth and length of hypolimnetic anoxia. The occurrence of an abundant littoral flora increased shallow water sedimentary pigment concentration but had little effect on deep water sediment in these lakes. The above relationships were used in interpreting the history of lake productivity from 1 m long sedimentary pigment profiles in 5 of the 6 lakes. In only one case, Duck Pond on Cape Cod, was there a close correlation between increased productivity and the onset of European settlement. In two other lakes productivity began to increase long before European settlement. Generally, productivity declined soon after settlement. Evidence for significant, recent, cultural eutrophication was found only for Stockbridge Bowl in the Berkshire Hills and for Duck Pond.
W83-01237

WHAT'S IN THE WATER,
J. Bathurst, L. J. Thomson, and L. F. Wilkinson.
Soil and Water, Vol 17, No 3, p 20-21, June, 1981. 2 Fig.

Descriptors: *Water quality, *Water analysis, *Well water, Drinking water, Wells, Water pollution sources, *New Zealand, Christchurch, *Groundwater, Sampling, *Bromide, *Chloride, Pollutant identification, Ions.

Groundwater in a 25 x 17 km area west of Christchurch, New Zealand, covering the recharge zone of the aquifer along the Waimakariri River to the Rolleston-Prebbleton area was sampled from May to August 1978. There are about 600 wells in the area, drawing water mainly from unconfined aquifers. The concentrations of bromide and chloride ions increased rather uniformly with increasing distance from the Waimakariri River. Specific known sources of ions, such as sites of irrigation of farm or industrial wastes, did have a local effect on the groundwater quality, but the effect was usually quickly lost through dilution. Bromide ions in general appeared in a constant ratio with chloride ions and thus there was no evidence for sustained and widespread elevated bromide levels being due to the discharge of bromide-containing industrial wastes, particularly in the Prebbleton area. Levels of bromide are very low and present no risk to health. (Baker-FRC)
W83-01292

AUTOMATED PREVALVE SAMPLE FILTRATION IN FLOW INJECTION ANALYSIS: DETERMINATION OF SULPHATE IN WATER REMOVING SUSPENDED SOLIDS AND COLOUR BEFORE SAMPLING,
Pretoria Univ. (South Africa). Dept. of Chemistry.
J. F. van Staden.
Fresenius' Zeitschrift fur Analytische Chemie, Vol 312, No 5, p 438-440, 1982. 1 Fig, 4 Tab, 2 Ref.

Descriptors: *Water analysis, *Spectrophotometry, *Measuring instruments, Sampling, Flow injection analysis, *Sulfate, Suspended solids, Color, Pollutant identification.

An automated flow-injection procedure is proposed in which the interference caused by suspended solids and the presence of organic substances and color are automatically removed by using an active carbon filter, which is incorporated in the flow system between the sampler and the sampling valve system. With this automated prevalve sample filter the proposed turbidimetric method gives the same results as a standard flow injection and an automated segmented method where the above mentioned interferences are manually removed prior to sampling. The method is applicable for the analysis of sulfate in surface, ground the domestic waters in the concentration range up to 200 mg/l at a sampling rate of up to 60 samples per hour with a coefficient of variation of better than 1%. (Baker-FRC)
W83-01303

QUANTITATIVE DETERMINATION OF VOLATILE HALOGENATED HYDROCARBONS IN WATER SAMPLES BY CAPILLARY GAS CHROMATOGRAPHY AND ELECTRON CAPTURE DETECTION,
Tuebingen Univ. (Germany, F.R.). Inst. fuer Organische Chemie.
H. Hagenmaier, G. Werner, and W. Jager.
Zeitschrift fur Wasser und Abwasser Forschung, Vol 15, No 4, p 195-198, August, 1982. 4 Fig, 2 Tab, 6 Ref.

Descriptors: *Chlorinated hydrocarbons, *Organic compounds, *Water analysis, *Pollutant identification, Chloroform, *Halogenated compounds, Chromatography, *Gas chromatography, Tubingen, *Germany, Lake Constance.

Volatile halogenated hydrocarbons were determined in water samples by liquid-liquid extraction with pentane and capillary gas chromatography. The problem of differences in extraction efficiency among the individual compounds was eliminated by using a standard solution containing the internal standard, 1-bromobutane, for calibration. This was equilibrated with water in the same ratio as used in the sampling procedure. Water samples from the Tuebingen municipal water supply and from Lake Constance were analyzed. Tuebingen water was higher in 1,1,2-trichloroethane (0.05 micrograms per liter), carbon tetrachloride (0.04 micrograms per liter), trichloroethylene (14.73 micrograms per liter), chlorodibromomethane (0.48 micrograms per liter), tetrachloroethylene (3.48 micrograms per liter), and bromoform (0.77 micrograms per liter). Lake Constance water was higher in chloroform (0.96 micrograms per liter) and dichlorobromomethane (1.05 micrograms per liter). Standard deviations for calibration mixtures corresponding to 0.4-8 micrograms per liter of each compound were 0.012-0.031 micrograms per liter; for water samples, 0.023-0.036 micrograms per liter. The detection limit was about 0.005 micrograms per liter. (Cassar-FRC)
W83-01338

A MICROPROCESSOR CONTROLLED SYSTEM FOR STORM WATER SAMPLING (EIN MIKROPROZESSOR-GESTEURTES SYSTEM ZUR PROBENNAHME AUS REGEN-EASSERKANALEN),
Hanover Univ. (Germany, F.R.). Inst. fuer Wasserwirtschaft, Hydrologie und Landwirtschaftlichen Wasserbau.
For primary bibliographic entry see Field 7A.
W83-01342

A PILOT STUDY OF POTENTIAL PHENOLIC CONTAMINATION OF FISHES IN THE COLUMBIA RIVER AND TRIBUTARIES IN THE VICINITY OF MOUNT ST. HELENS,
Beak Consultants, Inc., Portland, OR.
For primary bibliographic entry see Field 5C.
W83-01354

RELATIONSHIPS BETWEEN CANDIDA ALBICANS AND TRADITIONAL BACTERIAL INDICATORS OF POLLUTION IN WASTEWATER AND RECEIVING WATERS,
Connecticut Univ., Storrs. Inst. of Water Resources.
D. M. Hedden.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-146670, Price codes: A04 in paper copy, A01 in microfiche. MS Thesis, 1982. 72 p, 14 Fig, 10 Tab, 97 Ref. OWRT A-085-CONN(3).

Descriptors: *Water pollution indicators, *Yeast, *Wastewater pollution, *Candida, *Chlorination, Wastewater treatment, Effluents, Streptococcus, Water quality, Pathogenic fungi, Coliforms, Hydrogen ion concentration.

Candida albicans is a yeast and an opportunistic pathogen which is present in domestic wastewater and receiving water. Significant correlations were found between the traditional fecal indicators and C. albicans in wastewater. The correlation between C. albicans and the fecal streptococci was higher than the correlations between C. albicans and either the total or fecal coliforms. No significant correlations were found between C. albicans and any of the indicators in receiving water. Candida albicans was capable of extended survival in filtered raw sewage, river water, and distilled water; survival capability was significantly lower in sea water. Candida albicans survived exposure to moderte levels of chlorine; pH was a significant factor in these experiments. Three possible applications for the use of C. albicans as an indicator of water quality are (1) special problem studies of effluent discharge, (2) as a complimentary indicator for recreational water and pool use, and (3) as a chlorine resistant indicator.
W83-01362

REFINEMENT OF THE IDENTIFICATION AND SPECIATION SCHEMES OF FECAL STREPTOCOCCI,
Northern Arizona Univ., Flagstaff. Dept. of Microbiology.
A. M. Hekmati.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-147884, Price codes: A06 in paper copy, A01 in microfiche. MS Thesis, June 1981. 122 p, 3 Fig, 37 Tab, 22 Ref. OWRT A-096-ARIZ(2), 14-31-0001-0103.

Descriptors: *Streptococcus, *Bacterial analysis, *Microbiological studies, *Fecal pollution indicators, Water pollution, *Pollutant identification, Feces, Specification, Bacterial identification, Bioindicators, ATCC standards.

The EPA Schemes of identification and speciation of fecal streptococci were evaluated against nine standard streptococci obtained from the American Type Culture Collection (ATCC). The results of

the biochemical tests were found to be contrary to those expected from the schemes. As an alternate method of speciation a number of carbohydrate fermentation tests were done using the EPA guidelines. Although it was not possible to separate the standard organisms following the guidelines, two of the standard organisms were found to be the same since they produced identical fermentation test results as well as having an identical colonial morphologies. Several tests were found to be useful in the confirmation of the fecal streptococcus group. These included: gram stain reaction, cellular morphology, colonial morphology on KF-Streptococcal Agar, thermal resistance, and negative catalase test. Results of these tests were found to be common to all the standard fecal streptococci as well as all of the environmental isolates. Also, a speciation method based on carbohydrate discs and phenol red agar plates made it possible to speciate all of the standard organisms as well as the environmental isolates. The disc method is simple, more economical, and requires less time than the method proposed by the EPA.
W83-01365

VARIATION OF TRACE ELEMENT CONCENTRATION IN RAINWATER WITH RAINFALL RATE AND RAINFALL AMOUNT,
Bhabha Atomic Research Center, Bombay (India). Air Monitoring Section.
S. Sadasivan.
Mausam, Vol 31, No 2, p 222-224, April, 1980. 2 Fig, 16 Ref.

Descriptors: *Trace elements, *Rainwater, *Rainfall rate, *Water pollution sources, Monsoon, Chemistry of precipitation, *India, Iodine, Potassium, Bromine, Sodium, Chloride, Calcium, Magnesium.

Variations in the trace element concentrations in rainwater at Bombay and Lonavala are presented and discussed in relation to rainfall amount and rate. Collections were made during monsoon conditions. The results confirm the known inverse relation between concentration and rainfall rate as well as rainfall amount. The decrease in concentration with rainfall rate is related to increasing drop diameter and liquid water content of the precipitating cloud. The effect of washout on the trace element concentration in rainwater is not significant. The maximum to minimum concentration ratio is significantly less for I, K, and Br as compared to other elements such as Na, Cl, Ca, or Mg. (Baker-FRC)
W83-01379

CONTINUOUS MONITORING OF TOTAL AND INORGANIC MERCURY IN WASTEWATER AND OTHER WATERS,
Nagoya Univ. (Japan). Dept. of Engineering.
M. Goto, T. Shibakawa, T. Arita, and D. Ishii.
Analytica Chimica Acta, Vol 140, No 1, p 179-185, 1982. 7 Fig, 5 Ref.

Descriptors: *Monitoring, *Water quality, *Mercury, *Measuring instruments, *Spectrometry, Atomic absorption spectrometry, Chemical oxygen demand, Phosphorus, Nitrogen, *Water analysis, Automation.

An automated continuous monitoring system is presented for the determination of total as well as inorganic mercury by cold-vapor atomic absorption spectrometry. The method uses continuous flow digestion, reduction and extraction in small bore tubes at slow flow rates, and is suitable for use in the analysis of wastewater and natural waters. A detection limit of 0.1 ppb is obtained when a specially designed, complete gas-liquid separator is used, with a condenser circulated with ice-chilled water for removing water vapor and an 8-microliter flow cell for detection. The response times for the determination of inorganic and total mercury are about 3 and 5 minutes, respectively. The amount of reagents required is about one-tenth of that in conventional Auto-Analyzer methods. (Baker-FRC)
W83-01380

COMPARISON OF CONTINUOUS EXTRACTORS FOR THE EXTRACTION AND CONCENTRATION OF TRACE ORGANICS FROM WATER,
Dow Chemical Co., Midland, MI.
T. L. Peters.
Analytical Chemistry, Vol 54, No 11, p 1913-1914, 1982. 1 Fig, 1 Tab, 1 Ref.

Descriptors: *Water analysis, *Trace organics, *Extraction, Concentration, Measuring instruments, Continuous liquid-liquid extractors, Steam codistillation extractor, Steam distillation extractor, Flow under extractor, Flow over extractor.

A comparison was made to determine what extractors will best handle certain problems. The following extractors were considered in the evaluation: liquid-liquid extractor, steam codistillation extractor, steam distillation extractor, flow under extractor, and flow over extractor. For general use the SCDE and FUE/FOE appeared to be the most useful. In general purpose work where the aim is to extract everything possible with the solvent being used, the FUE/FOE would be optimum. When more specificity and a cleaner extract are desired, the SCDE can be used provided adequate precautions are taken to cover, for example, thermal stability and foaming problems. (Baker-FRC)
W83-01381

INFLUENCE OF KINETICS ON THE DIRECT TITRATION CURVES OF NATURAL WATER SYSTEMS - THEORETICAL CONSIDERATIONS,
Institut Rudjer Boskovic, Zagreb (Yugoslavia). Center for Marine Research.
I. Ruzic, and S. Nikolic.
Analytica Chimica Acta, Vol 140, No 1, p 331-334, 1982. 3 Fig, 4 Ref.

Descriptors: *Kinetics, Natural waters, *Titration, *Trace metals, *Copper, *Water analysis, Complex formation, Chemical reactions.

The effect of the rate of complex formation on the titration curves of natural waters with traces of metals is calculated. The effect can be distinguished from multiple complex formation. The problem of trace metal speciation has always been investigated by direct titration with a trace metal under conditions where equilibrium was not attained. The theoretical predictions presented in this study about the influence of the kinetics of complex formation on such titration curves should aid in the achievement of accurate results in cases where equilibrium is established. The procedure for the determination of metal-binding capacity suggested herein cannot be significantly affected by the kinetics of complex formation, which plays an important role only at free copper concentrations less than 20 micrograms/cubic dm. (Baker-FRC)
W83-01388

SPECTROPHOTOMETRIC DETERMINATION OF ALUMINUM IN RIVER WATER WITH BROMOPYROGALLOL RED AND N-TETRADECYLTRIMETHYLAMMONIUM BROMIDE BY FLOW INJECTION ANALYSIS,
Technical Univ., Lodz (Poland). Inst. of General Chemistry.
C. Wyganowski, S. Motomizu, and K. Toei.
Analytical Chimica Acta, Vol 140, No 1, p 313-317, 1982. 1 Fig, 2 Tab, 9 Ref.

Descriptors: *Aluminum, *Water analysis, *Spectrophotometry, Rivers, Natural waters, Flow injection analysis, Measuring instruments, Bromopyrogallol red, Tetradecyltrimethylammonium bromide, *Japan, Asahi River, Yoshii River, Takahashi River.

A sensitive spectrophotometric method for the determination of aluminum with bromopyrogallol red in the presence of n-tetradecyltrimethylammonium bromide has recently been proposed and applied to the determination of micro amounts of aluminum in natural waters. The present study describes the adaptation of this spectrophotometric reaction to flow injection analysis for the determination of aluminum in river waters. In the proposed system, the reagent solution contains bromopyrogallol red, n-tetradecyltrimethylammonium bromide and hexamine in 60% ethanolic solution, and the carrier solution contains acetate buffer, 1,10-phenanthroline and hydroxylammonium chloride. Sample solutions acidified by sulfuric acid are injected, and the peak absorbance at 623 nm is recorded. The detection limit is about 0.001 ppm, and calibration plots are linear for the ranges 0-0.3 and 0-0.1 ppm aluminum. (Baker-FRC)
W83-01389

5B. Sources Of Pollution

THE INFLUENCE OF ATMOSPHERIC NITROGEN INFLUX UPON THE STREAM NITROGEN PROFILE OF A RELATIVELY UNDISTURBED FORESTED WATERSHED,
Kentucky Univ., Lexington. Dept. of Agricultural Engineering.
J. R. Nuckols, and I. D. Moore.
Journal of Hydrology, Vol 57, No 1/2, p 113-135, May, 1982. 3 Fig, 8 Tab, 35 Ref.

Descriptors: *Nitrogen compounds, *Air pollution, *Streams, Ammonia, Nitrates, Organic nitrogen, West Fork Walker Branch, *Tennessee, Pollution load, Seasonal variation, *Forested watersheds, Watersheds, Water quality, Fate of pollutants, Statistical analysis, Deposition, Water pollution sources, Aeolian deposits, Wind deposits, Detritus.

The influx of atmospheric nitrogen compounds into West Fork Walker Branch, Tennessee, a relatively undisturbed 38.4 ha forested watershed, had a significant impact on the N chemistry of the stream. Six N chemistry variables (concentrations of ammonia-N, Nitrate-N, and organic N in the stream and the loading rates of each) and 27 independent variables (hydrologic, meteorological, and watershed characteristics and the N chemistry profile of wetfall, dryfall, and blow-in material) were statistically analyzed by a linear regression model. The magnitude of the atmospheric N input depended on season, vegetative cover, source of influx (wet, dry, and blow-in), and the form of N. Ammonia-N levels were more consistently related to atmospheric deposition of N compounds in all seasons. Atmospheric nitrate-N deposition was greatest in winter and summer; detrital nitrate-N flux, in spring. Nitrate leached from the soil and hydrologic factors were significant contributors to stream nitrate loads. Organic N levels were also highly dependent on seasonal characteristics. It was not possible to formulate a predictive relationship for the summer season from the statistical methods used in this study. (Cassar-FRC)
W83-01059

ORGANIC CONTAMINANTS IN GROUNDWATER NEAR AN UNDERGROUND COAL GASIFICATION SITE IN NORTHEASTERN WYOMING,
Lawrence Livermore National Lab., CA.
D. H. Stuermer, D. J. Ng, and C. J. Morris.
Environmental Science and Technology, Vol 16, No 9, p 582-587, 1982. 5 Fig, 4 Tab, 18 Ref.

Descriptors: *Groundwater pollution, *Coal gasification, *Organic compounds, *Wyoming, Groundwater, Water analysis, Water pollution sources, Gasification, Phenols, Aromatic compounds, Hydrocarbons, Amines, Monitoring, Water quality, Pollutant identification.

The composition of organic constituents observed over 15 months after the completion of gasification in groundwater samples from two aquifers near two different underground coal gasification (UCG) experiments at the Hoe Creek site in northeastern Wyoming is reported. Contaminants consisted of phenols, aromatic carboxylic acids, aromatic hydrocarbons, ketones, aldehydes, pyridines, quinolines, isoquinolines, and aromatic amines. Concentrations ranged up to about 50 ppm, with large variations both in the relative concentrations of acidic, neutral and basic constituents and in the concentrations of individual compounds. Naptha-

lene, 0-xylene, 2-methylpyridine, and 0-cresol were consistently present in high concentrations and were identified as UCG contaminant-indicator compounds that appear to be particularly useful for monitoring purposes. A simplified method of analysis for these compounds was developed. (Baker-FRC)
W83-01066

2,4,6-TRINITROTOLUENE-SURFACTANT COMPLEXES: DECOMPOSITION, MUTAGENICITY, AND SOIL LEACHING STUDIES,
Army Natick Research and Development Lab., MA.
D. L. Kaplan, and A. M. Kaplan.
Environmental Science and Technology, Vol 16, No 9, p 566-571, 1982. 4 Tab, 23 Ref.

Descriptors: *Industrial wastes, Public health, *Water pollution sources, *Leaching, Infiltration, Munitions wastes, *2,4,6-Trinitrotoluene, *Mutagenicity, *Decomposition, *Surfactants, Toluene, Organic compounds, Groundwater, Path of pollutants.

The biodegradability of TNT-surfactant complexes in soil and water was investigated and their mutagenicity assessed. The effectiveness of a proposed treatment of TNT-contaminated soils was also evaluated, involving complexing with surfactants to immobilize the TNT and prevent further leaching into the groundwater. Tests indicated that these complexes were more mutagenic than TNT alone. Soil leaching studies demonstrated that in situ immobilization of TNT in the complexed form in contaminated soils would not be feasible due to the large quantities of surfactant required and the inability of the surfactant treatment to immobilize TNT microbial reduction products. The leaching of excess surfactant and organic matter extracts into the groundwater is an additional disadvantage of the proposed treatment. Aqueous-anaerobic and soil decomposition studies showed that there are potential problems with he long-term stability of these complexes. Under these conditions in soil or water, water-soluble materials were produced non-biologically that could not be identified with TNT or any of seven known TNT reduction products. (Baker-FRC)
W83-01067

LEACHING OF CADMIUM FROM PIGMENTED PLASTICS IN A LANDFILL SITE,
Harwell Lab., Oxon (England).
D. C. Wilson, P. J. Young, B. C. Hudson, and G. Baldwin.
Environmental Science and Technology, Vol 16, No 9, p 560-566, 1982. 3 Fig, 1 Tab, 14 Ref.

Descriptors: *Waste disposal, *Cadmium, *Landfills, Plastics, Leaching, Water pollution control, Metals, Path of pollutants.

Experiments were conducted to determine whether cadmium-pigmented plastics make a significant contribution to the release of cadmium in landfill leachates. With consideration of the maximum case of 15% plastics in refuse and use of a pessimistic estimate of a peak cadmium removal of 0.5 mg/kg bed volume from the 2.5% of all plastics that contain cadmium pigment, a maximum leaching concentration of 2 micrograms/liter is suggested by the leaching tests. The low levels released suggest that the leaching observed is only from the surface of the plastic and not the bulk. Several column validation experiments were performed with pulverized domestic waste and a worst case plastic, and these demonstrated that pigmented plastics make an insignificant contribution to cadmium levels in domestic waste leachate. Thus landfill is an acceptable disposal option for cadmium-pigmented plastics. (Baker-FRC)
W83-01068

MASS BALANCE MODELING OF DDT DYNAMICS IN LAKES MICHIGAN AND SUPERIOR,
Environmental Research Lab.-Duluth, Grosse Ile, MI. Large Lakes Research Station.
V. J. Bierman, Jr., and W. R. Swain.
Environmental Science and Technology, Vol 16, No 9, p 572-579, 1982. 5 Fig, 6 Tab, 49 Ref.

Descriptors: *Lakes, *Pesticides, *Water pollution control, *Lake Michigan, Great Lakes, *Lake Superior, *DDT, Fate of pollutants, Agricultural chemicals, Oganic compounds, Fish, Particulates.

Data available from Lakes Michigan and Superior were used for a retrospective analysis of DDT dynamics subsequent to the imposition of the ban in 1969 on DDT use. Trends indicate that DDT levels in both lakes declined at greater rates than were expected on the basis of hydraulic detention times and the degradation rate for DDT in the environment. Under the given assumptions, settling of particulate DDT from the water column was found to be the major loss process of DDT for both lakes. Particulate settling was responsible for 61-95% of the observed DDT loss rate in Lake Michigan. Degradation and hydraulic washout were responsible for 3-35% and 2-4%, respectively. Results for Lake Superior were comparable. These ranges corresponded to results for analyses of sensitivity to variations in external DDT loads, partition coefficients, and degration half-times. Results for apparent net particulate settling velocities for DDT were consistent with analogous results for phosphorus, phytoplankton, and plutonium from independent studies. (Baker-FRC)
W83-01069

THE DEFINITION AND USE OF MIXING ZONES,
Dow Chemical Co., Midland, MI.
For primary bibliographic entry see Field 5G.
W83-01070

THE DISTRIBUTION OF LEAD, ZINC AND CADMIUM IN SEDIMENTS OF AN ORE-ENRICHED LOTIC ECOSYSTEM, THE RIVER ECCLESBOURNE, DERBYSHIRE,
Institute of Terrestrial Ecology, Huntingdon (England). Monks Wood Experimental Station.
F. Moriarty, K. R. Bull, H. M. Hanson, and P. Freestone.
Environmental Pollution, Series B, Vol 4, No 1, p 45-68, July, 1982. 7 Fig, 13 Tab, 24 Ref.

Descriptors: *Sediments, Rivers, *Metals, *Lead, *Zinc, *Cadmium, Heavy metals, Ecclesbourne River, *England, Fate of pollutants, Organic matter, Particle size.

Sediment samples were collected from 22 sites and 7 tributaries on the River Ecclesbourne in Derbyshire, England, to study lead, zinc, and cadmium derived from natural mineral veins and disused mines. Surveys were conducted in February-March 1976 and November 1977. Sediments were graded into three mesh sizes: Grade 1, 1.0 mm; Grade2, 0.5-1.0mm ; and Grade 3, 0.5 mm. Metals levels generally decreased downstream. The ratio of Cd:Zn also decreased downstream. There were pulses of sediments with relatively high metals concentrations that moved down the river. This was reflected in the significant differences in metals levels at the same site on different dates. The smallest particles tended to have the lowest Zn and Cd levels at most sites. There was little difference between the two grades of larger particles for all three metals. For Pb, differences between the three grades were not pronounced. In the upper reaches of the river Cd levels were over 100 mg per Kg, exceptionally high for rivers in England and Wales. The organic content of the sediments (2.1-3.5%) increased downstream but did not affect metals contents. (Cassar-FRC)
W83-01073

DEPOSITION AND CHEMISTRY OF POLLUTANT METALS IN LAKES AROUND THE SMELTERS AT SUDBURY, ONTARIO,
National Water Research Inst., Burlington (Ontario).
J. O. Nriagu, H. K. T. Wong, and R. D. Coker.
Environmental Science and Technology Vol 16, No 9, p 551-560, 1982. 9 Fig, 7 Tab, 68 Ref.

Descriptors: *Lakes, *Sediments, *Smelting, Water pollution sources, Heavy metals, Copper, Nickel, Zinc, Lead, Sediments, Sudbury, *Ontario, Canada, Suspended solids.

Since the smelters in Sudbury emitted about 2.6 tons of Ni, 2.6 tons of Cu, 0.7 tons of Pb, and 6.3 tons of Fe, daily during 1977 the area around Sudbury represents a unique laboratory for studying the long-term impacts of airborne pollutants on aquatic ecosystems. Organic matter constitutes 35-60% of the suspended materials in nearby lakes, but plays a minor role in the transport of metals to the sediments. Rates of metal accumulation in the sediments have been estimated typically to be 100-600, 50-300, 10-60, and 5-30 sq m/yr for Ni, Cu, Zn, and Pb, respectively. Some of the lakes with pH values of 4.5 or less show no enrichment or accumulation of pollutant metals in their surface sediments, indicating that pollutant metals previously stored in the sediments have since been leached away. This finding that the contaminated sediments can release substantial quantities of toxic metals to the overlying water must have interesting ramifications with regard to the limnological impacts of acid rains. (Baker-FRC)
W83-01078

PHOTOLYSIS OF HEXACHLOROCYCLOPENTADIENE IN WATER,
Velsicol Chemical Corp., Chicago, IL.
R. G. Butz, C. C. Yu, and Y. H. Atallah.
Ecotoxicology and Environmental Safety, Vol 6, No 4, p 347-357, August, 1982. 8 Fig, 2 Tab, 8 Ref.

Descriptors: *Degradation, *Chlorinated hydrocarbons, *Hexachlorocyclopentadiene, *Photolysis, Fate of pollutants, Organic compounds, Insecticides, Mirex, Kepone, Radiation.

Hexachlorocyclopentadiene (Hex), an intermediate in the manufacture of insecticides and chemicals, dissolved in water at a concentration of 2.2 micrograms per ml, decomposed rapidly under mercury vapor lamp irradiation. The photolytic half-life of HEX was < 1.03 min. After 10 min of irradiation 44% of the compound had been converted to water soluble products. The primary photolysis product was pentachlorocyclopentenone. Dimerization products similar to hexachloroindenone were also formed. However, no mirex or Kepone were detected in the reaction mixture. Previous suggestions that photolysis is the major process responsible for HEX degradation in such ecosystems as ponds and eutrophic lakes were thus apparently confirmed. (Cassar-FRC)
W83-01079

AN ANALYSIS OF FACTORS INFLUENCING DE-ICING SALT LEVELS IN STREAMS,
Ontario Hydro, Toronto. Dept. of Transmission Environment.
W. S. Scott.
Journal of Environmental Management, Vol 13, No 3, p 269-287, November, 1981. 9 Fig, 11 Tab, 11 Ref.

Descriptors: *Deicers, *Roads, *Streams, Fate of pollutants, *Salts, Runoff, Thawing, Drainage patterns, Urbanization, Rainfall, Black Creek, Don River, Toronto, *Ontario.

Factors affecting the input of deicing salts into streams were studied in the Black Creek and Don River, Toronto, Ontario. Salt inputs were significantly correlated with: (1) the length and type of road drainage into the stream, (2) the amount of salt applied prior to thaw periods, and (3) the road drainage pattern and topography. Salt levels and duration in the stream were affected by: (1) discharge of the receiving stream, and (2) degree of urbanization. At the point source inputs (road crossings) salt inputs were related to: (1) the rate of rise of temperature at the start of a thaw, (2) duration of temperature above freezing, (3) amount of salt applied prior to the thaw, and (4) amount of rainfall during the thaw. The most important independent variable for explaining salt input load was heat accumulated during a thaw. For a given thaw chloride concentrations and lost varied in a similar manner at points in each study area. However, the Black Creek had much higher salt concentrations

and much lower loads than the Don River. (Cassar-FRC)
W83-01088

STREAM WATER QUALITY IN A SMALL COMMERCIAL CAMPGROUND IN COLORADO,
Rocky Mountain Forest and Range Experiment Station, Fort Collins, CO.
H. L. Gary.
Journal of Environmental Health, Vol 45, No 1, p 5-12, July/August, 1982. 6 Fig, 1 Tab, 22 Ref.

Descriptors: *Recreation, *Waste disposal, *Camp sites, Fate of pollutants, Water pollution sources, Horse Creek, *Colorado, Water quality, Streams.

The influence of a campground on stream water quality was studied during the summer of 1978 at Horse Creek, Colorado. Water samples were collected biweekly, as well as three times daily before and after the three summer holiday weekends, Memorial Day, July 4, and Labor Day. The chemical and physical qualities, including bacterial densities, were not adversely affected by recreational use of the site. This indicated that the waste disposal facilities (septic tanks) were performing satisfactorily. Suspended solids in the stream, which had little fine silt and clay, rose during periods when persons were playing in the stream but immediately dropped to normal off-season levels when there was no activity in the water. (Cassar-FRC)
W83-01090

DECOLORIZATION OF INFILTRATION WATER UNDER NATURAL CONDITIONS,
Akademiya Nauk SSSR, Moscow. Inst. Biologii Vnutrennykh Vod.
For primary bibliographic entry see Field 2F.
W83-01097

EFFECT OF MICROBIAL LIFE STAGES ON THE FATE OF METHYLMERCURY IN NATURAL WATERS,
Alberta Environmental Center, Vegreville.
S. Ramamoorthy, T. C. Cheng, and D. J. Kushner.
Bulletin of Environmental Contamination and Toxicology, Vol 29, No 2, p 167-173, August, 1982. 4 Fig, 1 Tab, 16 Ref.

Descriptors: *Mercury, *Bacteria, Sample preservation, *Fate of pollutants, *Methylmercury, Sediments, Microbiological studies, Algae, Cyanophyta, Escherichia coli, Pseudomonas fluorescens, Anabaena flos-aquae, *Ottawa River, *Ontario.

Transformations of methylmercury chloride to inorganic mercury were studied in samples of Ottawa River water, to which had been added natural sediment, living or thermally killed bacteria (Escherichia coli or Pseudomonas fluorescens), or a blue-green alga (Anabaena flos-aquae). Transformations of methylmercury in cultures of growing bacteria were also studied. Hg concentrations were set at 0.1 mg per liter to simulate severe Hg contamination. Living organisms rapidly converted methylmercury chloride to inorganic Hg. On the seventh day the percentages of inorganic Hg in various suspensions of living organisms were: P. fluorescens, 90%; E. coli, 50.6%; and A. flos-aquae, 83.4%. Water overlying the living organisms contained low levels of both forms of Hg. Experiments with thermally killed suspensions of organisms showed that most of the methylmercury and all of the inorganic Hg was bound to the dead cells within 12 hours. No transformations took place for 3 days. By the seventh day about half the inorganic Hg in the stock solution, containing 28% inorganic Hg, was transformed to methylmercury chloride, most of which was released to the water column. P. fluorescens growing in peptone-yeast extract broth media quickly converted methylmercury chloride to inorganic Hg, most of which was eventually lost as volatile Hg. No transformation of methylmercury chloride took place in E. coli cultures. Results suggest that proper storage conditions and minimum storage time is important in handling samples containing Hg. (Cassar-FRC)
W83-01104

THE SPECIATION OF IONS IN TIBER RIVER ESTUARY WATERS,
Miami Univ., FL.
F. J. Millero, G. Macchi, and M. Pettine.
Estuarine, Coastal and Shelf Science, Vol 13, No 5, p 517-534, November, 1981. 10 Fig, 10 Tab, 22 Ref.

Descriptors: *Speciation, *Estuarine environment, *Ions, Tyrrhenian sea, Chemical composition, *Italy, Chemical properties, Tiber Riber, Estuaries, Path of Pollutants.

The Tiber River basin is exploited for agricultural and industrial use, with both activities having an effect on the chemical composition of the Tiber itself. The population of the area is about 4.2 million concentrated in six urban areas, the greatest being Rome, which is located near the mouth of the river. At present raw untreated sewage is discharged from Rome. Due to the short distance between the Aniene inlet and Tiber mouth, most of these polluted waters are discharged into Tyrrhenian Sea. The composition of the major ionic constituents of the Tiber River waters was analyzed from literature data. The ratios of the major cations and anions to chloride are strongly influenced by tributary waters (Paglia, Nera and Aniene rivers). The speciations of the major cations and anions have been determined for waters formed by mixing lower Tiber river waters and Tyrrhenian sea waters of constant composition. The results are compared to similar calculations for mixing average river waters with seawater. The total or stoichiometric activity coefficients for the major ionic components have been determined from the speciation results. Values for the ionization constant of weak acids in the waters were found to be in reasonable agreement with values determined at the same absolute salinity. (Baker-FRC)
W83-01118

URANIUM, THORIUM AND LEAD NUCLIDES IN A DELAWARE SALT MARSH SEDIMENT,
Delaware Univ., Newark. Coll. of Marine Studies.
T. M. Church, C. J. III Lord, and B. L. K. Somayajulu.
Estuarine, Coastal and Shelf Science, Vol 13, No 3, p 267-275, September, 1981. 4 Fig, 3 Tab, 33 Ref.

Descriptors: *Radionuclides, *Salt marshes, *Sediments, Uranium, Thorium, Lead, *Delaware, Trace metals, Chemical analysis.

Natural isotopes of uranium, thorium, and lead have been assayed in sediments from a lower Delaware salt marsh. Uranium is concentrated in the top sections of the core and decreases with depth, from 3 to 1 d/min/g. A significant proportion of this uranium has been authigenically extracted from seawater, as is demonstrated by the observed excess ration of U234:U238(1.03-1.14). Thorium 232 is rather consistant in concentration, while the concentration of Th230 is deficient with respect to its uranium parent. In contrast to the deep sea, the fixation of authigenic reduced uranium dominates over the scavenging of Th230 in these tidal sediments. Excess Pb210 showed an exponential decay over the length of the core, and when corrected for a correspondingly significant exponential decrease in organic carbon and salt, yields a sedimentation rate of 0.47 cm/year. Although this rate approximates the local apparent rate of sea level rise, a lower limit for the rate of salt marsh accumulation, the actual rate is higher, suggesting net filling and accretion of salt marshes. The total integrated flux of Pb210 to this and other salt marsh surfaces in the eastern U.S. is calculated to more often exceed the reported local atmospheric flux. It appears that salt marshes may scavenge Pb210 as has been shown for other trace metals, from flooding waters.
W83-01123

THE DEPOSITION OF WINDSCALE RADIOCAESIUM IN THE WYRE ESTUARY AND THE MEASUREMENT OF SEDIMENTATION RATES,
International Lab. of Marine Radioactivity, Monte Carlo (Monaco). Oceanographic Museum.
S. R. Aston, and J. E. Rae.
Marine Environmental Research, Vol. 7, No. 2, p 83-90, 1982. 1 Fig, 2 Tab, 21 Ref.

Descriptors: *Estuaries, *Water pollution sources, *Sediments, *Radiocesium, Cesium, Isotopes, Radioisotopes, *Sedimentation rates, Windscale Nuclear Facility, Nuclear fuels, *England.

Sediment profiles from the Wyre estuary, Northwest England, have been analyzed for their Cs-137 and Cs-134 activities and the percent less than 63 microm grain size fractions. The results indicate that sediments are contaminated with radiocesium isotopes derived from the Windscale nuclear fuel reprocessing facility about 60 km north of the Wyre estuary. The activities of the radiocesium in different core segments are correlated with the percent less than 63 microm grain size fraction variations in the sediment profiles, but the ratios of Cs-134 to Cs-137 isotopic patterns in the cores and in the Windscale annual discharges have allowed estimates of the net sedimentation rates to be calculated. The range of values obtained was 2 to 3.6 cm/year. However, these results are probably subject to errors of about 10% based on experimental errors alone. (Baker-FRC)
W83-01138

AVON-HEATHCOTE, ESTUARY UNDER STRESS,
Canterbury Univ., Christchurch (New Zealand). Dept. of Zoology.
R. Stephenson.
Soil and Water, Vol. 16, No. 2, p 22-25, April, 1980. 4 Fig.

Descriptors: *Estuaries, *Water resources development, *Water pollution effects, *Water pollution sources, Nutrients, Nitrogen, Phosphorus, Water quality, Industrial wastes, Decomposing organic matter, *New Zealand, Avon-Heathcote Estuary.

The Avon-Heathcote Estuary has reflected the drastic alteration of its drainage basin by changes in its own physical, chemical and biological characteristics. Changes in vegetation, drainage patterns and land cover altered the nature and degree of flow characteristics and sedimentation. Domestic and industrial effluents discharged into the rivers and into the estuary proper have had far-reaching effects on the kinds and number of plants and animals within the estuary. Effluent discharge into the estuary has two components - toxic chemicals and organic matter. Toxic industrial pollutants mainly enter via the Heathcote River and include arsenic and chromium compounds from tanneries; hydrochloric acid from glue factories; acids, alkalies and sulfur compounds from woolen mills; bisulfate of lime from wool scours; acids, copper and lead from metalworks; and tars and oils from gas works. Some of the changes which have occurred at this estuary are reversible, and the estuary itself still appears to be carrying out its primary role. (Baker-FRC)
W83-01149

ANIONIC SURFACTANT CONCENTRATION IN THE RIVER AND SEA WATERS OF HYOGO PREF. AND ITS RELATIONSHIP TO PHOSPHORUS CONCENTRATION, (IN JAPANESE),
Hyogo Prefecture Environmental Science Inst., Kobe (Japan).
Y. Kobuke.
Japanese Journal of Limnology, Vol 42, No 4, p 189-200, October, 1981. 7 Fig, 5 Tab, 35 Ref. (English Summary).

Descriptors: *Surfactants, *Water pollution sources, *Detergents, Hyogo Prefecture, *Japan, Rivers, Seawater, Phytoplankton, Water pollution control, *Phosphorus, Pollutant identification.

The distribution of anionic surfactants determined as methylene blue active substances (MBAS) in the river and sea waters of Hyogo Prefecture was investigated. The method was corrected for the interference of photosynthetic pigments of phytoplankton. MBAS concentration in thee river waters was higher in the coastal areas of Osaka Bay and Harima Nada, where population and in-

dustry were centralized. Concentrations greater than 1 mg/liter were observed, especially in smaller rivers. In the sea waters of Osaka Bay and Harima Nada, the highest concentration of MBAS was found near the northern coasts where a high concentration of MBAS was noted in river waters. The findings suggest that anionic surfactant pollution of the river and sea waters was due largely to domestic and industrial effluents. The annual loadings of anionic surfactant as MBAS were estimated by statistical data to be about 11,000 tons per year, 37% from industry and the rest from domestic waste. Due to the good correlation between MBAS and various forms of phosphorus it was presumed that detergents including condensed phosphates as a builder may cause an increase in phosphorus concentration in the river water. (Baker-FRC)
W83-01152

DISTRIBUTIONS OF HEAVY METALS IN BOTTOM MUD AND POLYGONUM NODOSUM IN THE WATARASE RIVER (IN JAPANESE),
Takasaki Coll. of Economics, Gumma (Japan).
F. Tada, Y. Wada, and S. Suzuki.
Japanese Journal of Limnology, Vol 43, No 1, p 44-47, January, 1982. 3 Fig, 7 Ref. English summary.

Descriptors: *Bottom sediments, *Heavy metals, Algae, Lead, Copper, Cadmium, Zinc, Mud, Rivers, Water pollution effects, Industrial wastes, Polygonum nodosum, Watarase River, *Japan, *Path of pollutants.

The distribution of copper, zinc, lead, and cadmium was investigated in both samples of bottom mud and samples of Polygonum nodosum obtained from the Watarase River. This river is heavily polluted with drainage from refineries. Mud samples collected from upstream near the pollution source and the downstream alluvial fan were highly polluted with metals. These results indicate that the metal concentration of mud was related to the slope of the river bed. The amount of heavy metals in P. nodosum had a relationship with 0.1M EDTA extractable metals in the mud. P. nodosum collected from upstream showed high metal contents. Judging from these results it was suggested that the chemical form of metals in the mud may differ from upstream to downstream. (Baker-FRC)
W83-01175

WATER-TABLE MAP OF THE SAN JOSE WELL FIELD AND VICINITY, ALBUQUERQUE, NEW MEXICO, SPRING 1981,
Geological Survey, Albuquerque, NM. Water Resources Div.
For primary bibliographic entry see Field 7C.
W83-01184

TIME OF TRAVEL OF SOLUTES IN THE VERMILION RIVER, LOUISIANA,
Geological Survey, Baton Rouge, LA. Water Resources Div.
A. J. Calandro.
OFSS, USGS. Box 25425, Fed. Ctr. Denver, CO 80225. Paper copy $2.50, Microfiche $3.50. Geological Survey Open-File Report 81-1065, 1981. 19 p, 13 Fig, 3 Tab, 5 Ref.

Descriptors: Streamflow, *Dye releases, *Tracers, *Path of pollutants, Flow rates, Streams, Tracking techniques, Solutes, *Louisiana, Vermilion River, Time of travel.

Dye-tracer studies were made in November 1978 and in June 1979 to define streamflow patterns in the Vermilion River. For the November 1978 study the tracer was injected at two locations, Surrey Street in Lafayette and about 7 miles downstream at State Highway 3073; the discharge at Surrey Street at the time of injection was 218 cubic feet per second. The two dye clouds merged at Broussard Cemetery, about 12.2 miles downstream from Surrey Street, after an elapsed time of about 270 hours. After 438 hours the dye cloud extended form the Abbeville bridge (Louisiana Highway 14 Bypass) upstream about 14.5 miles. In June 1979, a tracer was injected into the river at Surrey Street at Lafayette; the discharge at Surrey Street at the time of injection was 161 cubic feet per second. Forty-two hours after injection the leading edge of the tracer was located at the Milton pumping plant, 14 miles downstream from the injection site. The average pumping rate of the plant during the study was 440 cubic feet per second. Ninety hours after injection, no indication of the tracer was found in the river, but the tracer was found in a rice-irrigation cannal at State Highway 14, about 10 miles west of Abbeville. (USGS)
W83-01189

STREAMFLOW AND WATER-QUALITY CONDITIONS, WILSONS CREEK AND JAMES RIVER, SPRINGFIELD AREA, MISSOURI,
Geological Survey, Rolla, MO. Water Resources Div.
For primary bibliographic entry see Field 4C.
W83-01192

ADSORPTION AND DESORPTION OF HEAVY METALS IN BOTTOM MUD OF URBAN RIVERS,
Takasaki Coll. of Economics, Gumma (Japan). Chemical Lab.
F. Tada, and S. Suzuki.
Water Research, Vol 16, No 10, p 1489-1494, October, 1982. 1 Fig, 11 Tab, 18 Ref.

Descriptors: *Rivers, *Bottom sediments, *Heavy metals, Copper, Zinc, Cadmium, Lead, Mud, Urban areas, Adsorption, Organic compounds, Fate of pollutants, *Japan, Yahagi River, Tsuoumi River.

The main factors influencing the adsorption of Zn, Cu, Cd, and Pb in urban rivers were investigated. The chemical forms of the adsorbed metals were identified. Adsorption of Cu, Zn, Cd, and Pb was described using the Freundlich adsorption equation. The Freundlich constant was related to the grain size and organic matter content of bottom mud. It was found that the main factor controlling the adsorption of metal was organic matter, since the adsorbed metals decreased remarkably due to the destruction of organic matter from the fine bottom mud. The desorption experiment proved that the metals adsorbed by mud were extracted about 100% with dilute hydrochloric acid. Therefore, the amount of heavy metal adsorbed per g of total organic carbon can be calculated from the acid soluble metal content of bottom mud. Moreover, the method of extraction by 2N CH3C00NH4 can be used to distinguish between an ion exchangeable form adsorbed by minerals and a chemical form adsorbed by organic matter.The Adsorption and desorption experiments indicated that fine bottom mud with a high organic matter content contributed to the uptake of metals in urban rivers and that such metals can be extracted with 0.5 N HC1. (Baker-FRC)
W83-01194

MICROBIAL CONTAMINATION OF CONTINENTAL SHELF SEDIMENTS BY WASTEWATER SLUDGE,
Environmental Protection Agency, Annapolis, MD.
M. L. O'Malley, D. W. Lear, W. N. Adams, J. Gaines, and T. K. Sawyer.
Journal of the Water Pollution Control Federation, Vol 54, No 9, p 1311-1317, September, 1982. 3 Fig, 4 Tab, 21 Ref.

Descriptors: *Sludge disposal, *Bacteria, *Marine sediments, Fate of pollutants, Ocean dumping, *Middle Atlantic Bight, Disposal, Microorganisms, Amoebae, Parasites, Pathogens, Sediments, Coliforms, Streptococci, Indicators, Delaware Bay.

Surface sediment samples from the region around on ocean wastewater sludge disposal site in the Middle Atlantic Bight, 71 km southwest of the mouth of Delaware Bay, contained significant levels of coliforms (TC), fecal coliforms (FC), fecal streptococci (FS), and Acanthamoeba. Sampling was conducted on 6 cruises from April 1978 to August 1980. The highest percentage of positive stations (38% of stations positive for TC and 25% for FC) was located within 9 km of the disposal site center. The percentage of positive stations decreased with increasing distance from the center of the dumpsite. Positive samples were found as far as 37 km from the center. Sludge tended to travel in northeast and southwest directions and to settle in low spots. An area of at least 1190 sq km of ocean bottom was affected by the sludge dumping. The percentage of positive stations decreased with time. TC, FS, and amoebae were more persistent in sediments than FC. Therefore, FC can be considered an indicator of recent sludge deposition. (Cassar-FRC)
W83-01214

ACID DEPOSITION,
For primary bibliographic entry see Field 5C.
W83-01217

POTENTIAL EUTROPHICATION OF THE RIDEAU RIVER BY AN URBAN WATERWAY: DISCUSSION,
Gore and Storrie Ltd., Toronto (Ontario).
For primary bibliographic entry see Field 5C.
W83-01219

THE ESTABLISHMENT OF WATER QUALITY GRADIENTS IN RESERVOIRS,
Army Engineer Waterways Experiment Station, Vicksburg, MS.
R. H. Kennedy, K. W. Thornton, and R. C. Gunkel, Jr.
Canadian Water Resources Journal, Vol 7, No 1, p 71-87, 1982. 6 Fig, 16 Ref.

Descriptors: *Water quality, *Reservoirs, Physical properties, Chemical properties, Lake morphology, Hydrodynamics, Sedimentation, Hydrology, Tributaries, Mixing, West Point Lake, *Georgia, Phosphorus, Chlorophyll, Suspended solids, Turbidity.

Results are presented of three intensive water quality surveys conducted at West Point Lake, Georgia, during 1979. The findings document the existence of marked longitudinal gradients in the concentrations of total phosphorus, chlorophyll a and suspended solids (turbidity) from headwater to dam in this large reservoir. Comparisons of data from cove and main-pool stations also indicated the presence of significant lateral heterogeneities. The occurrence of such gradients must be noted in the design, implementation and interpretation of sampling programs if effective management strategies are to be developed for ameliorating reservoir water quality problems. Marked physical, chemical, and biological gradients were noted in West Point Lake related to lake morphology, hydrodynamics, sedimentation, hydrology and inflow water quality. Of these, tributary size and location as well as channel slope and reservoir length to width relationships appear to be principal factors. Within limits established by these factors, sedimentation and mixing processes further dictate the fate of influent nutrients and material and their impact on biological communities. (Baker-FRC)
W83-01222

MATHEMATICAL MODEL FOR DISSOLVED OXYGEN IN THREE SOUTHERN ONTARIO RESERVOIRS,
Johns Hopkins Univ., Baltimore, MD. Dept. of Geography and Environmental Engineering.
W. J. Snodgrass.
Canadian Water Resources Journal, Vol 7, No 1, p 397-415, 1982. 4 Fig, 1 Tab, 24 Ref.

Descriptors: *Mathematical models, *Dissolved oxygen, *Reservoirs, *Ontario, Canada, Model studies, Mathematical equations, Oxygen, Water analysis, Stratification, Vertical transport, Temperature effects, Wind.

The rate of hypolimnetic oxygen depletion in reservoirs of the Grand River system (Southern Ontario) has been analyzed with the objective of developing mathematical models capable of predicting oxygen regimes and of being used by water

quality managers. The oxygen regimes of these reservoirs are dominated mainly by watershed inputs and internal biochemical processes. In this work, it is hypothesized that oxygen decay is controlled by land-base inputs of phosphorus and that decay may be modeled using the phosphorus cycle in each reservoir. A temperature model was selected to make predictions of vertical transport and showed good agreement with observations during most of the year in cases where wind data was available from near each reservoir, but poor agreement when data from some distance was used. It predicts extensive mixing near the end of summer stratification. These problems result from atmospheric boundary effects caused by the lee effects afforded by surrounding hills. A phosphorus-oxygen model was modified for application. Oxygen decay was estimated by the decay of particulate phosphorus. It was concluded that a reasonable calibration was obtained, but that a reasonable verification was not obtained due to inadequate predictions of vertical mixing, particularly near the end of stratification. (Baker-FRC)
W83-01227

FATE OF POLYCHLORINATED BIPHENYLS (PCBS) IN SOIL PLANT SYSTEMS,
North Carolina State Univ. at Raleigh. Dept. of Biological and Agricultural Engineering.
D. Pal, J. B. Weber, and M. R. Overcash.
Residue Reviews, Vol. 74, 1980, p. 45-98. Springer-Verlag New York. OWRT B-122-NC (8), 14-34-0001-9088.

Descriptors: *Polychlorinated biphenyls, Land-Application Plant uptake, *Decomposition, *Soil adsorption, Toxicity, Aromatic hydrocarbons, Water pollution effects, *Fate of pollutants, *Food chain, *Aroclors, *Soil-Plant Systems.

Polychlorinated biphenyls are a family of snythetic chlorinated aromatic organics that are thermally, chemically, and electrically very stable. Only recently these substances have been traced as contaminates far from the centers of production and use. Toxicity, metabolic fate, and environmental chemistry of PCBs are the topics of much current study. Individual PCB species and isomers vary widely in their susceptibility to biodegradation. All isomers of mono- and di-chlorobiphenyls are degraded by a number of aerobic soil microorganisms. Many isomers of tri -, and tetra-chlorinated species are also degraded but a few are more resistant to biodegradation and metabolism. Only a few isomers of penta- and hexa-chlorobiphenyls are known to biodegrade and most of the isomers are very persistent. With increasing solubility in water, even the most persistent ones biodecompose at finite rates. Many isomers of tri-, tetra-, and penta-, and hexa-chlorobiphenyls have not been studied and virtually nothing is known about the fate of hepta-, octa-, and nona-chlorobiphenyls in the soil-plant environment. Because of the toxicity and accumulative nature of highly chlorinated PCBs, the soil assimilative capacity design for land treatment must be considered on very conservative terms. PCBs do decompose in a soil system, probably more rapidly than in any other waste management alternative or receiver system involving biological activity. Research is needed to establish the terrestrial rates of decomposition of all species and isomers that are present in Aroclors, and to find the soil levels above which the application of different PCB consistents adversely affects the food chain.
W83-01235

SEEPAGE PONDS TO RECYCLE MUNICIPAL WASTEWATER,
South Dakota State Univ., Brookings. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5D.
W83-01238

EFFECTS OF A HEXACHLOROBIPHENYL AND PENTACHLOROPHENOL ON GROWTH AND PHOTOSYNTHESIS OF PHYTOPLANKTON,
New York State Dept. of Health, Albany. Environmental Health Center.
For primary bibliographic entry see Field 5C.
W83-01242

OVERVIEW OF PHYTOPLANKTON CONTAMINANT PROBLEMS,
New York State Dept. of Health, Albany. Environmental Health Center.
G-Y. Rhee.
Journal of Great Lakes Research, Vol. 8, No. 2, p 326-327, 1982. 13 Ref.

Descriptors: *Air-water interfaces, *Phytoplankton, *Accumulation, Fate of pollutants, Surface films, Films, Water pollution effects, *Chlorinated hydrocarbons, Adsorption, Bioaccumulation, Organic compounds, *Polychlorinated biphenyls.

The surface film communities of planktonic algae (phytoneuston) are exposed to pollutant concentrations higher than in the subsurface water. Adsorption of organochlorine compounds is much faster than desorption, indicating that contaminated cells, after a return to more dilute subsurface waters, may not desorb the pollutants rapidly or completely. The bioaccumulation factor or partition coefficient increases with decreasing biomass per unit volume. Certain low levels of organochlorine pollutants stimulate photosynthesis in phytoplankton. This mechanism has a destabilizing effect on the ecology and may have potential significance in human toxicology. (Cassar-FRC)
W83-01243

MICROBIOTA IN SURFACE FILMS: AN HISTORICAL PERSPECTIVE,
New York State Dept. of Health, Albany. Environmental Health Center.
G. W. Fuhs.
Journal of Great Lakes Research, Vol. 8, No. 2, p 312-315, 1982. 29 Ref.

Descriptors: *Bacteria, *Air-water interfaces, *Degradation, Reviews, *Microbiological studies, Fate of pollutants, Biodegradation, Organic matter, *Surface films, Films, History.

Microbiota at the air-water interface have been the subject of research for 50 years. The ubiquitous organic surface film and the significant enrichment of bacteria produce sampling errors in microbiological studies. The microbiota contribute to organic content of the microlayer as a result of their metabolism, actively degrade organic pollutants, and produce oil-dispersing surfactants. The environment of the film approaches that of a culture media. The bacteria-rich layer is an important consideration in swimming pools and in stagnant areas near docks. (Cassar-FRC)
W83-01245

OVERVIEW OF ATMOSPHERIC INPUTS AND LOSSES FROM FILMS,
Minnesota Univ., Minneapolis. Dept. of Civil and Mineral Engineering.
S. J. Eisenreich.
Journal of Great Lakes Research, Vol. 8, No. 2, p 241-242, 1982. 9 Ref.

Descriptors: *Air-water interfaces, *Aerosols, *Enrichment, Fate of pollutants, *Surface films, Lakes, Particulate matter, Chlorinated hydrocarbons, Organic compounds, Polychlorinated biphenyls, Metals, Deposition, Air pollution, Films.

A surface film on water bodies contains particulate matter with greater concentrations of metal and organic matter than the subsurface water. The film thickness may vary from 0.002 microns (monomolecular layer) to 0.02 microns, with 30 microns (stagnant diffusion film) as an extreme case. Typical particulate diameters are 0.1-4 microns. Enrichment factors in the surface film are 1000-10,000. In heavily polluted environments 20-90% of the metal burden in the surface film is derived from particle deposition; in pristine waters, from in-lake processes. Airborne particles and aerosols contribute significantly to pollution in surface films and are readily available for reaction with the biotic community. (Cassar-FRC)
W83-01246

BACTERIONUESTON INVOLVED IN THE OXIDATION OF HYDROCARBONS AT THE AIR-WATER INTERFACE,
Calgary Univ., (Alberta). Dept. of Biology.
R. C. Wyndham, and J. W. Costerton.
Journal of Great Lakes Research, Vol 8, No 2, p 316-322, 1982. 8 Fig, 1 Tab, 22 Ref.

Descriptors: *Air-water interfaces, *Bacteria, *Hydrocarbons, Fate of pollutants, Degradation, Biodegradation, Microbial degradation, Oil slicks, Bitumen, Microbiological studies, *Neuston, Surface films, Polymers, Polysaccharides, Films.

Neuston microorganisms in a community of bituminous hydrocarbon degraders were observed using the techniques of critical point drying and thin sectioning with transmission electron microscopy. The mixed bacterial population was isolated from sediments of the Steepbank River, Alberta, in the oil sands region. Bacteria formed a continuous layer, 5-15 microns thick, of polymeric polysaccharide mat within 3-6 weeks of growth. The most rapid growth occurred in areas of thinnest oil cover. The process of biodegradation may involve an initial hydrophobic exclusion of cells at the interface followed by a stronger adhesion consolidated by the extracellular polymer produced. Cell fragments and other organic particulate matter accumulated at the air-water interface. In an undisturbed mixed population culture growing on Athabasca bitumen surface film for 120 days at 22 C the saturate, aromatic, and first polar fractions were strongly degraded, leaving a residue of polar fractions 2 and 3 and asphaltene. Total recovery of bitumen was 40%. (Cassar-FRC)
W83-01247

TRACE METAL ACCUMULATION IN SURFACE MICROLAYERS,
Wisconsin Univ., Madison, Dept. of Civil and Environmental Engineering.
D. E. Armstrong, and A. W. Elzerman.
Journal of Great Lakes Research, Vol 8, No 2, p 282-287, 1982. 6 Tab, 16 Ref.

Descriptors: *Metals, *Enrichment, *Air-water interfaces, Reviews, *Trace metals, Surface films, Fate of pollutants, Fallout, Heavy Metals, Aerosols, Residence time, Particulate matter, Films.

Factors controlling trace metal accumulation in surface microlayers of water bodies include properties and composition of the microlayer, form of the trace metal, source of the trace metal, processes controlling metal transport to and through the microlayer, longevity of the microlayer, and residence time of metal in the microlayer. The presence of slicks and surface matter greatly increases enrichment of metals. The particulate phase is richer in metals than the dissolved phase. Trace metals may enter the surface film from atmospheric fallout or from the underlying water. Residence times of metals in the microlayer vary from a few seconds under wind conditions of 5-10 m per sec (particulate Fe) to 0.6 hours for particulate Pb under calm conditions. (Cassar-FRC)
W83-01248

ATMOSPHERIC ROLE IN TRACE METAL EXCHANGE AT THE AIR-WATER INTERFACE,
Minnesota Univ., Minneapolis. Dept. of Civil and Mining Engineering.
S. J. Eisenreich.
Journal of Great Lakes Research, Vol 8, No 2, p 243-256, 1982. 2 Fig, 13 Tab, 65 Ref.

Descriptors: *Air-water interfaces, *Metals, *Enrichment, Fate of pollutants, Surface films, *Lake Superior, *Lake Michigan, Lakes, *Trace metals, Heavy metals, Fallout, Aerosols, Residence time, Bubbles, Films.

Trace metals levels in Lake Superior surface films were higher than in subsurface water. Sources of these metals were atmospheric fallout and in-lake bubble scavenging processes. In Lake Superior most of the Fe, Mn, Ca, Pb, Cr, Zn, Cd, and Ni in the surface film was derived from in-lake processes. Previous work on Lake Michigan films indicated significant metals contributions from atmos-

pheric fallout. Enrichment factors (surface film/subsurface water) for total metals were 2-10; for particulate metals, 0-36. Lake aerosols were enriched in Cu, Pb, Zn, and Cd as a result of bubble bursting at the air-water interface. Residence times of the metals in the surface film were 16-83 min for Fe, Al, Mn, Pb, Cr, Zn, and Cd and near zero for Ca and Mg. (Cassar-FRC)
W83-01255

PESTICIDE PARTITIONING IN ARTIFICIAL SURFACE FILMS,
Canada Center for Inland Waters, Burlington (Ontario).
R. F. Platford.
Journal of Great Lakes Research, Vol 8, No 2, p 307-309, 1982. 1 Fig, 1 Tab, 15 Ref.

Descriptors: *Pesticides, *Enrichment, *Solubility, *Air-water interfaces, Chlorinated hydrocarbons, Polychlorinated biphenyls, *Surface films, *Partition coefficients, Organic matter, Films.

Octanol partition coefficients for 4,4'-dichlorophenyl and for 2,3,4,5-tetrachlorobiphenyl were 10-1000 times higher when octanol was in the form of a film on a water surface than in bulk form. This agreed with results from previous studies on lindane, DDT, and hexachlorobenzene. The logs of the partition coefficients were: 4,4'-dichlorobiphenyl (concentration 0.3-5 ppb), 5.2 bulk and 6.7-7.7 surface; and 2,3,4,5-tetrachlorobiphenyl (concentration 0.05-0.5 ppb), 5.9 bulk and 7-9 surface. Results show that surface slicks on natural waters can accumulate much higher concentrations of chlorinated compounds than the bulk partition coefficients indicate. (Cassar-FRC)
W83-01256

OVERVIEW OF CONTAMINANT INTERACTIONS WITH SURFACE FILMS, ZOOPLANKTON, AND FISH,
Minnesota Univ., Minneapolis. Dept. of Ecology and Behaviroal Biology.
D. C. McNaught.
Journal of Great Lakes Research, Vol 8, No 2, p 358-359, 1982. 6 Ref.

Descriptors: *Air-water interfaces, *Enrichment, *Zooplankton, Fate of pollutants, Fish, Surface films, Films, Lipids, Food chains, Phytoplankton, Organic matter.

The surfaces of the Great Lakes and other water bodies are covered with a film of lipid-rich organic matter in which zooplankton and fish are exposed to contaminants during excursions to the surface. Work to define the mechanisms and effects of this region of concentration pollutants produced mixed results. Some investigators found that equilibrium partioning was an important mechanism regulating pollutant concentrations in lipids of small organisms; concentration was less important than lipid content. The hypothesis that zooplankton feeding on organic surface films could receive 10 times more contaminants than similar populations in subsurface waters is difficult to verify. Other workers concluded that partitioning accounted for very little of the contaminants reaching the top predator, in contrast to conclusions about smaller organisms. Concentrations of pollutants were 1000 times higher in phytoplankton than in water and 1 million times higher in zooplankton than in water. (Cassar-FRC)
W83-01257

CALCULATED CONTRIBUTION OF SURFACE MICROLAYER PCB TO CONTAMINATION OF LAKE MICHIGAN LAKE TROUT,
Manhattan Coll., Bronx, NY. Dept. of Environmental Engineering and Science.
J. P. Connolly, and R. V. Thomann.
Journal of Great Lakes Research, Vol 8, No 2, p 367-375, 1982. 5 Fig, 2 Tab, 14 Ref.

Descriptors: *Air-water interfaces, *Enrichment, *Chlorinated hydrocarbons, Fate of pollutants, Trout, *Lake Michigan, Lakes, Surface films, Alewife, Films, Polychlorinated biphenyls, Flood chains, Model studies, Zooplankton, Phytoplankton.

Results of a food chain model indicated that a maximum of 12% (3 micrograms per g) of the PCB concentration in adult lake trout could be derived from the surface microlayer of Lake Michigan. The model was calibrated to the Lake Michigan pelagic food chain structure. Zooplankton were assumed to spend part of the day feeding in the surface film, which contained 2.1 times higher PCB levels than the subsurface water. Average PCB concentrations in each level of the food chain, with zooplankton exposure to the microlayer, were: phytoplankton, zooplankton, and mysis, < 1 microgram per g wet weight; alewife, 4.2 micrograms per g; and trout, 14.5 micrograms per g. Critical parameters in the model are the enrichment factor in the microlayer (greatest in windrows) and the percentage of time spent by zooplankton in the microlayer. (Cassar-FRC)
W83-01258

ENRICHMENT OF PCBS IN LAKE MICHIGAN SURFACE FILMS,
Michigan Univ., Ann Arbor. Great Lakes Research Div.
C. P. Rice, B. J. Eadie, and K. M. Erstfeld.
Journal of Great Lakes Research, Vol 8, No 2, p 265-270, 1982. 1 Fig, 2 Tab, 22 Ref.

Descriptors: *Polychlorinated biphenyls, *Air-water interfaces, *Enrichment, Chlorinated hydrocarbons, Surface films, Films, *Lake Michigan, Lakes, Aroclors, Fate of pollutants, Organic compounds, Particulate matter.

Polychlorinated biphenyl (PCB) distribution in Lake Michigan surface film and underlying water was determined from analysis of samples collected during three cruises in 1979-1980. The PCB concentrations (ng per kg) were: air, 2.8 (average); surface microlayer, 3.30-50.13; and subsurface water, 1.11-11.18. The percentages of Aroclor 1254 in the total PCB mixture (Aroclor 1254 plus Aroclor 1242) were: air, 30.3%; surface microlayer, 54.4-58.0%; and subsurface water, 62.0-65.9%. Aroclor 1254's preferential adsorption was related to its higher partition coefficient and higher degree of chlorination. Of the total PCB (particulate and dissolved), particulate PCB comprised 30.0-66% in the microlayer, 17.4-23.6% in the subsurface water, and < 5% in the air. (Cassar-FRC)
W83-01259

MODELING TRACE METALS IN THE SURFACE MICROLAYER,
Clemson Univ., SC. Dept. of Environmental Systems Engineering.
A. W. Elzerman.
Journal of Great Lakes Research, Vol 8, No 2, p 257-264, 1982. 4 Fig, 31 Ref.

Descriptors: *Air-water interfaces, *Enrichment, *Metals, *Model studies, Trace metals, Surface films, Films, Fate of pollutants, Kinetics, Aerosols, Residence time, Reviews, Isotope studies, Mixing.

This paper reviews some of the modeling approaches for investigating trace metal enrichment in surface microlayers. These techniques concern sources, sinks, and concentration controlling mechanisms. Two approaches have been used to quantitate fluxes to and from the surface film: (1) estimation of previous fluxes from measurements of trace metals entering or leaving the film and (2) measurement or modeling of fluxes at the boundaries of the film. These approaches use calculation of enrichments, element ratios and correlations, tracer elements, chemical element balances, and factor analyses. The equilibium concentration in the surface microlayer may be studied with models of competitive complexation and by a computer-based equilibrium speciation model (REDEQL). Studies on kinetics of interactions in the surface microlayer have been undertaken only recently. They concentrate on particle residence time and reactivity. (Cassar-FRC)
W83-01260

SHORT CYCLING OF CONTAMINANTS BY ZOOPLANKTON AND THEIR IMPACT ON GREAT LAKES ECOSYSTEMS,
Minnesota Univ., Minneapolis. Dept. of Ecology and Behavioral Biology.
D. C. McNaught.
Journal of Great Lakes Research, Vol 8, No 2, p 360-366, 1982. 4 Tab, 24 Ref.

Descriptors: *Zooplankton, *Polychlorinated biphenyls, *Air-water interfaces, Fate of pollutants, Short cycling, Cycling, Surface films, *Organic matter, Detritus, Sublethal effects, Chlorinated hydrocarbons, Predation, Phytoplankton, Fish, Accumulation, Bioaccumulation, Food habits, Films, Great Lakes.

There is clear laboratory evidence of short cycling of organic contaminants at the air-water interface directly into zooplankton and fish. In short cycling bioconcentration in phytoplankton is not involved. However, field data are relatively scarce. The common mechanisms for incorporating the surface contaminants into the higher life forms are ingestion of organic matter platelets and detritus. Zooplankton vary in their susceptibility to accumulation of surface contaminants depending on time spent in the surface layer, choice of food organisms or resuspending detritus, and daily patterns of feeding. Omnivore zooplankton consuming phytoplankton and polychlorinated biphenly (PCB)-containing detritus took up 144 micrograms per g; when fed phytoplankton alone, only 60 micrograms per g. However, Chydorus and Diaptomus, selecting large cells rather than detritus, accumulated 32 micrograms PCB per g in the presence of large cells alone and 18 micrograms per g in an environment of large cells plus detritus. Low levels (25 micrograms per liter) of PCB reduced grazing activity in zooplankton as much as 43%. PCB also affects population growth by decreasing egg production and increasing death rates. (Cassar-FRC)
W83-01263

REVERSIBLE AND RESISTANT COMPONENTS OF PCB ADSORPTION-DESORPTION: ADSORBENT CONCENTRATION EFFECTS,
Manhattan Coll., Bronx, NY. Environmental Engineering and Science Program.
D. M. Di Toro, L. M. Horzempa, M. M. Casey, and W. Richardson.
Journal of Great Lakes Research, Vol 8, No 2, p 336-349, 1982. 10 Fig, 3 Tab, 11 Ref.

Descriptors: *Polychlorinated biphenyls, *Adsorption, *Sediments, Fate of pollutants, Chlorinated hydrocarbons, Hexachlorobiphenyl, Partition coefficient, *Saginaw Bay, Particulate matter, Suspended sediments, Model studies, Desorption, *Lake Huron.

The partition coefficient of ploychlorinated biphenyls (PCB), as 2,4,5,2',4',5'-hexachlorobiphenyl, decreased with increasing concentrations of adsorbent (Saginaw Bay sediment). Adsorption and desorption were not completely reversible. This effect was analyzed with an adsorption-desorption model with resistant and reversible components. The resistant component showed essentially constant partitioning; the reversible component partition coefficient was inversely related to the adsorbent concentration. Data from adsorption-desorption experiments corresponded to model results. Adsorption-desorption behavior varied among different types of sediments used. The resistant component partition coefficient varied strongly, whereas the reversible component varied weakly. (Cassar-FRC)
W83-01264

OVERVIEW OF MICROBIOTA IN SURFACE FILMS,
New York State Dept. of Health, Albany.
G. W. Fuhs.
Journal of Great Lakes Research, Vol 8, No 2, p 310-311, 1982. 5 Ref.

Descriptors: *Air-water interfaces, *Bacteria, *Enrichment, Fate of pollutants, Surface films, Degradation, Beidegradation, Lakes, Organic matter, Organic compounds, Films, Great Lakes.

Surface microlayers on water bodies are universally colonized by bacteria and other microorganisms.

Initial anchoring is due to the organism's interaction with the film-forming chemicals. Additional immobilization is a result of a fibrous polysaccharide exopolymer excreted by the bacteria. The sticky substance also effectively adsorbs chemicals and complexes metals. Bacterial numbers are enriched 8-24 times in the surface film compared with subsurface water. The more eutrophic waters have more pronounced surface slicks. Surface films continually concentrate organic matter and other contaminants, which are bacterially degraded faster in the film than if the pollutants had remained dispersed through the water column. (Cassar-FRC)
W83-01265

FRACTIONATION OF HYDROPHOBIC ORIGIN MATERIALS IN SURFACE MICROLAYERS,
Michigan Univ., Ann Arbor. Dept. of Atmospheric and Oceanic Science.
P. A. Meyers, and O. E. Kawka.
Journal of Great Lakes Research, Vol 8, No 2, p 288-298, 1982. 3 Fig, 3 Tab, 49 Ref.

Descriptors: *Air-water interfaces, *Organic compounds, *Solubility, Films, Surface films, Fatty acids, *Lake Michigan, Lakes, Particulate matter, Alkanes, Hydrocarbons, Fate of pollutants, Great Lakes.

Organic microlayers on the surface of Lake Michigan were sampled during 1977 at 10 open lake stations located along the north-south transect and at river mouth and nearshore stations. Surface film concentrations of organic matter and fatty acids were higher in dissolved and particulate phases than subsurface waters. The subsurface concentrations remain constant down to a depth of 5 m. In the lake stations dissolved organic carbon concentrations were 5 times greater than those of particulate organic carbon. There was considerable interstation variability in concentrations of organic materials. Formation of the surface film was dependent on aquatic biological processes rather than on river input. Hydrocarbons in the microlayer and subsurface water included long chain compounds (terrigenous origin), short chain compounds (algal origin), and pristane, phytane, and squalene (aquatic origin). The large solubility differences among the different organic compounds did not influence surface/subsurface fractionation as much as input and removal processes. (Cassar-FRC)
W83-01266

MODELS OF PARTICLE DRY DEPOSITION TO A LAKE SURFACE AND SOME EFFECTS OF SURFACE MICROLAYERS,
Illinois Univ. at the Medical Center, Chicago. School of Public Health.
J. A. Schmidt.
Journal of Great Lakes Research, Vol 8, No 2, p 271-280, 1982. 6 Fig, 2 Tab, 33 Ref.

Descriptors: *Air-water interfaces, *Deposition, *Mass transfer, Surface films, Films, Lakes, Aerosols, Bubbles, Great Lakes, *Lake Michigan, *Model studies, Particulate matter, Roughness coefficient, Particle size, Organic matter, Metals, Fate of Pollutants, Waves, Diffusion coefficent, Wind velocity.

An evaluation of empirical and theoretical models of dry deposition shows that uncertainty exists in calculating fluxes for particles and their chemical components. Mechanisms responsible for particle transport between air and water are gravitational settling, eddy diffusion, and Brownian diffusion. These processes are dependent on particle size and density, particle height, wind speed, atmospheric stability, and surface roughness. Although surface microlayers can decrease roughness, they have signifacant cotrol over deposition rates only at a very low level. Bursting bubbles may be an important factor in determining net atmospheric loading rates because metals and organic contaminants are enriched in the surface film. (Cassar-FRC)
W83-01267

WATER QUALITY CONSIDERATIONS IN THE SLURRY PIPELINING OF COAL,
Arkansas Univ., Fayetteville. Dept. of Civil Engineering.
J. W. Moore.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-139923, Price codes: A09 in paper copy, A01 in microfiche. Arkansas Water Resources Research Center Publication No 84, August 1981. 185 p, 129 Fig, 8 Tab, 32 Ref. OWRT B-059-ARK(1). 14-34-0001-6058.

Descriptors: *Coal, *Coal slurry pipelines, *Wastewaters, *Water pollution, *Industrial wastewater, Calcium, Sodium, Manganese, Nickel, Chlorides, Fluorides, Sulfates, Hardness, Biochemical oxygen demand, Chemical oxygen demand, Alkalinity.

Because the interest in coal slurry pipelining was initially concentrated in the west, there is little information available concerning the effects of slurry pipelining of eastern coal on water quality. Extensive water quality investigations were conducted using two eastern coals and various water sources to determine the coal-water relationships. The biochemical oxygen demand concentrations in slurry wastewaters were considerably less with eastern coal than western coal. The alkalinity concentrations in slurry wastewaters prepared with eastern coal were all low and tended to decrease with increasing detention time. The chemical oxygen demand concentrations were relatively low. Calcium and total hardness concentrations were very high in slurry wastewaters prepared with both eastern coals. The average chloride concentrations were 90 and 1,500 mg/l for slurry wastewaters prepared with the Kansas and Illinois coals, respectively. Measurable quantities of fluoride and lead were present in the slurry wastewaters. Manganese and sodium concentrations were a function of coal source. Significant nickel concentrations were present in slurry wastewaters prepared with both eastern coals. The sulfate concentrations were high. (Moore-SRC)
W83-01273

EFFECTIVENESS OF SEPTIC SYSTEMS IN SAFEGUARDING THE GROUNDWATER IN MAINE,
Maine Univ. at Orono. Dept. of Plant and Soil Sciences.
For primary bibliographic entry see Field 5G.
W83-01278

INFLUENCE OF PARTICLE SIZE DISTRIBUTION ON WATER QUALITY IN AGRICULTURAL IMPOUNDMENTS,
Missouri Univ.-Columbia. Dept. of Civil Engineering.
M. M. Ghosh, and T. Lochmoeller.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-140020, Price codes: A09 in paper copy, A01 in microfiche. Completion Report, Sept 30, 1982. 185 p, 56 Fig, 14 Tab, 47 Ref, Append. OWRT A-132-MO(1), 14-34-0001-2127.

Descriptors: *Particle size distribution, Water quality, Sediment, Coagulation, Metals, *Missouri, Callahan Reservoir, Big River, Black River, *Lead, Path of pollutants, *Sediment measurement, *Mine wastes, Agricultural impoundments.

In recent years, the development of electric particle counters has created opportunities for more sensitive measurement of liquid-solid associations than has been possible previously. Very few particle size distribution (PSD) measurements have been made for natural systems. This research investigates the changes in PSD in a reservoir following storm events and the role PSD plays in transporting lead introduced into a river system by a mine tailings spill. The reservoir chosen for study is an agricultural flood retarding reservoir in central Missouri. Particle counting was by electrozone (coulter) method. Particle numbers vs. diameter, when plotted on log-log paper showed a linear relationship which can be characterized as a slope. A general pattern of change in the slope of PSD's following a storm was observed. Sediment-laden influents show relatively flat PSD slopes indicating a high percentage of large particles. Settling results in a steeper PSD slope. Gradually, PSD slopes become flatter, indicating the effect of coagulation. Additional PSD analyses were done for sediment samples from Big River in southeast Missouri in an effort to trace the fate of lead from mine tailings. Small particles control the transport of lead in Big River.
W83-01280

EVALUATION OF MICROCOSMS FOR DETERMINING THE FATE AND EFFECT OF BENZ(A)ANTHRACENE IN AQUATIC SYSTEMS,
Utah Water Research Lab., Logan.
J. G. Dickson, V. D. Adams, and D. B. George.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-140046, Price codes: A06 in paper copy, A01 in microfiche. UWRL Water Quality Series UWRL/Q-82/02, October, 1982. 95 p, 34 Fig, 8 Tab, 119 Ref. OWRT A-049-UTAH(1), 14-34-0001-0147.

Descriptors: Environmental quality, *Carcinogens, *Microenvironment, Contamination, Hydrocarbons, *Benz(a)anthracene, *Fate of pollutants, *Water pollution effects, *Aromatic hydrocarbons, *Biota, Pollutant identification, Industrial wastes.

Small scale, three-phase microcosms were used to study the aquatic fate and effect of a polycyclic aromatic hydrocarbon (PAH), benz(a)anthracene. This compound was chosen as a model for carcinogenic PAH because it is a typical constituent of petro-chemical effluents and has middle-of-the-range physical and chemical characteristics. In a series of experiments, techniques were established for monitoring the behavior and for assessing the biological response to the pollutant. Results indicate that benz(a)anthracene has no acute effect on aquatic organisms as indicated by the parameters used to measure community structure and function (gas productivity, nutrient utilization, biomass accumulation, and species composition). Gas chromatograph/mass spectral analysis of benz(a)antracene and metabolites in the medium sediment, and biota made it possible to trace the fate of the compound. At the end of one 60 day experiment, 76 percent remained in the sediment, 17 percent had been recovered in the medium, 1 percent had attached to the microcosm surfaces, and less than 1 percent was associated with the biota. Of the remaining 5 percent, a portion was photodegraded. There was no evidence of metabolism.
W83-01282

THE DEVELOPMENT OF PHYTOPLANKTON POPULATIONS AND NUTRIENTS IN A TIDAL RIVER UNDER DROUGHT CONDITIONS,
Rutgers - The State Univ., New Brunswick, NJ. Dept. of Zoology.
M. A. Foote, and R. E. Loveland.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-140053, Price codes: A06 in paper copy, A01 in microfiche. Completion Report, September, 1982. Division of Water Resources, Center for Coastal and Environmental Studies, Rutgers University. 110 p, 18 Fig, 3 Tab, 119 Ref. OWRT A-063-NJ(1), 14-34-0001-1132.

Descriptors: *Algae, *Diatoms, Plant populations, *Drought conditions, Water use, *New Jersey, *Nutrients, Tidal rivers, Path of pollutants, Pollutant identification, *Hackensack River, Water supplies, *Phytoplankton, *Organic enrichment.

Chemical and physical measurements were made at 6 stations along a 15 km segment of the upper Hackensack River from July 1980 to October 1981. Temperature, salinity, and concentrations of nitrate-nitrogen, ortho-phosphate, total hardness, alkalinity, silica and sulfate were all greater towards the lower end of the estuary. Dissolved oxygen concentrations were generally greater upstream. Ninety-nine species of planktonic algae were identified. Cell number/milliliter varied from 1080 to 240,000 during the course of the study and chlorophyll-a values varied from 1.33 to 270.9 mg/cubic meter. Additionally, 159 species of diatoms

were identified after acid-cleaning of the phytoplankton samples. The dominant species were centric forms. Diversity was measured using the Shannon Index. Diversity was slightly lower in the upper estuary during the summer months. Succession and algal periodicity are also discussed. Field work and literature searches were performed concerning the history, geology and vascular plants of the area. The Hackensack River as a source of potable water is also investigated.
W83-01283

WHAT'S IN THE WATER,
For primary bibliographic entry see Field 5A.
W83-01292

WATCHING THE RIVER'S FLOW.
Soil and Water, Vol. 17, No. 3, p 26-27, June, 1981. 1 Fig.

Descriptors: *Water pollution sources, *Rivers, *Industrial wastes, Tarawera River, Horticulture, Pulp and paper industry, Kawerau, *New Zealand, Color, Odor.

The Tarawera River (New Zealand) runs from Lake Tarawera to the sea. Between the Lake and Kawerau, the river remains relatively unpolluted. During the rest of its journey there are three main discharges made into its waters. The Caxton Paper Mill Ltd. discharges stormwater, water containing settling tank sludge, filter sludge, spent chemicals and clarified effluent. Another discharger is the Kawerau Borough Sewage Treatment Plant, with an estimated BOD loading of 150 kg/day. The third major discharger is the Tasman Pulp and Paper Company Plant. This third discharger is causing problems from both a pollution and an administrative point of view. In particular, an 80% reduction in color from Tasman's effluent would be needed before any noticeable improvement in the river would be observed. In the near future it is expected that horticulture will begin to be a major industry in this area, and thus cleanup of this river becomes all the more urgent. (Baker-FRC)
W83-01310

MOBILIZATION OF COPPER FROM MODIFIED PEAT BY DISSOLVED ORGANIC MATTER IN NATURAL WATERS AND BIOLOGICALLY PURIFIED WASTEWATERS,
Agricultural Univ., Wageningen (Netherlands). Dept. of Water Pollution Control.
J. Bovendeur, J. C. L. van Buuren, and J. A. Jacobs.
Zeitschrift fur Wasser und Abwasser Forschung, Vol 15, No 4, p 181-186, August, 1982. 2 Fig, 3 Tab, 14 Ref.

Descriptors: *Copper, *Organic matter, *Chelation, Fate of pollutants, Sediments, Lake sediments, Effluents, Aeration, Peat, Organic compounds, *Dissolved organic carbon, *The Netherlands, Lake Tjeukemeer, Lake Nijkerkernauw.

Copper mobilization was studied in natural waters and wastewater effluents using a sulfuric acid-heat-modified peat containing 8 mg per g Cu to simulate organic matter in aquatic sediments. Water samples (200 ml) exposed to 50 mg Cu-containing organic matter for 24 hours at 0 C showed increased ability to mobilize Cu at higher levels of dissolved organic carbon. Secondary effluents mobilized more Cu than natural lake waters. Aeration also dramatically increased Cu mobilization. The mobilization capacities (micrograms Cu per mg dissolved organic carbon) were: Lake Tjeukemeer, 1.6-1.9: Lake Nijkerkernauw, 2.5-2.8; three secondary effluents (total of 11 samples), 2.3-7.0; anaerobically digested potato wastewater, 2.1; and aerated anaerobically digested potato wastewater, 9.9. The changes produced by aeration were the result of elimination of poorly-mobilizing materials and formation of organic compounds with better mobilizing properties. (Cassar-FRC)
W83-01341

EFFECTS OF WATER ON THE FATE OF HERBICIDES IN IRRIGATED SOILS,
Arkansas Univ., Fayetteville. Dept. of Agronomy.
T. L. Lavy.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-146365, Price codes: A08 in paper copy, A01 in microfiche. Arkansas Water Resources Research Center, Publication No 86, Fayetteville, August 24, 1982. 156 p, 26 Fig, 21 Tab, 65 Ref, 2 Append. OWRT B-057-ARK(1), 14-34-0001-8133.

Descriptors: *Herbicides, *Irrigation effects, *Leaching, *Soil water, *Pesticide kinetics, Metribuzin, Metolachlor, Fluometuron, Pendimethalin, Solubility, Adsorption, Pesticide residues, Fate of pollutants.

The wide use of soil-applied herbicides necessitates an understanding of their fate in soil if we are to use them in the most beneficial manner. All herbicides have some degree of water solubility and the field performance of many are dependent on ample, timely availability of soil moisture. It is important that different aspects of soil-herbicide-water interactions be thoroughly investigated. An excess use of water for irrigation purposes can result in the downward movement of herbicides in the soil profile. Subsoils are less adsorptive and a decreased degradation potential exists when herbicides move below the top 15 cm. In sandy soils, or other areas where extensive irrigation is planned it is prudent to attempt to choose a herbicide with high adsorptive capacity and low water solubility. Leaching of metribuzin, metolachlor, and fluometuron was an important dissipation process for each of the chemicals over the winter months when degradation was slow. Pendimethalin dissipation was greater in alternatively flooded and dried soil than with soil water content at 1/3 bar tension or with a continuous flood. In a laboratory degradation study, over 59% of the oxadiazon persisted after 20 weeks. In a greenhouse study its biological activity was reduced and its persistance increased when applied below the soil surface.
W83-01355

USEFULNESS OF SEDIMENT OXYGEN AS A TOOL FOR IMPOUNDMENT MANAGEMENT,
Illinois State Water Survey Div., Champaign.
M. J. Barcelona, and W. Wang.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-146761, Price codes: A03 in paper copy, A01 in microfiche. Research Report No 169, Univ. of Illinois, Urbana-Champaign, Water Resources Ctr., 1982. 40 p, 4 Fig, 7 Tab, 37 Ref. OWRT A-105-ILL(1), 14-34-0001-1115.

Descriptors: *Oxygen demand, *Sediment-water interfaces, *Oxygen sag, *Sulfides, Chemical oxygen demand, Oxygen requirements, Mud, Lake sediments, Aeration, Anaerobic conditions, Water pollution effects, Hydrogen sulfide, Mineralogy, *Illinois, *Sediment oxygen demand, Impoundments.

Sediment erosion and transport have a significant effect on water quality in agricultural watersheds. In the midwest there are many man-made impoundments which experience severe sediment-related problems. Sediment Oxygen Demand (SOD) measurements have great practical utility for the management of sediment-impacted lakes for which sediment dredging or aeration/destratification schemes represent viable rehabilitation schemes. The report summarizes a fifteen-month study of the phenomenon of SOD in shallow Illinois impoundments. Both lakes have served as public water supplies and experienced significant water quality problems associated with sediment accumulation or seasonal anoxia. The aims of the investigation were to identify the principal components of the SOD and to develop an optimized SOD procedure. Briefly, batch respirometric measurements of SOD were found to be most diagnostic of oxygen depletion due to sediment resuspension or disturbance. As such, the bulk of the demand could be identified as chemical, and associated with sediment solids rather than due to reduced soluble species in sediment pore waters. Sulfide minerals contributed to the SOD in nearly all cases. An improved method for the determination of acid-soluble sulfide was developed to permit correlation of sulfide levels with sulfidic SOD.
W83-01371

HEAVY METAL CONCENTRATIONS IN SHRIMP, CRAB, AND SEDIMENT OBTAINED FROM AD-DAMMAM SEWAGE OUTFALL AREA,
College of Petroleum and Minerals, Dhahran (Saudi Arabia). Research Inst.
M. Sadiq, T. H. Zaidi, A. ul-Hoda, and A. A. Mian.
Bulletin of Environmental Contamination and Toxicology, Vol 29, No 3, p 313-319, September, 1982. 3 Tab, 18 Ref.

Descriptors: *Invertebrates, *Heavy metals, *Sediments, Metals, Shrimp, Crabs, Fate of pollutants, Marine sediments, Outfalls, AD-Dammam, *Saudi Arabia, Arabian Gulf.

Concentrations of heavy metals in sediments and shellfish collected in June 1981 at the AD-Dammam, Saudi Arabia, municipal outfall in the Arabian Gulf were reported. Average concentrations of metals in shrimps and crabs (micrograms per g of wet tissue) and sediments (micrograms per g of sediment), respectively, were: Cd, 0.087, 0.043, 2.9; Cr, 0.059, 0.12, 18.1; Co, 0.98, 1.15, 23.9; Cu, 6.93, 12.32, 11.2; Ni, 0.54, 0.57, 28.6; Pb, 0.73, 1.32, 10.0; Zn, 32.02, 40.92, 22.2. (Cassar-FRC)
W83-01391

ENRICHMENT OF COPPER, ZINC, MANGANESE, AND IRON IN FIVE SPECIES OF PONDWEEKS (POTAMOGETON SPP.),
Turku Univ. (Finland). Dept. of Biology.
K. Aulio, and M. Salin.
Bulletin of Environmental Contamination and Toxicology, Vol 29, No 3, p 320-325, September, 1982. 2 Tab, 15 Ref.

Descriptors: *Aquatic plants, *Indicators, *Heavy metals, Metals, Copper, Zinc, Manganese, Iron, Enrichment, Kokemaenjoki River, *Finland, Estuaries, *Potamogeton, Fate of pollutants, Submerged plants, Macrophytes.

Average levels of heavy metals (micrograms per g dry weight) in 5 species of Potamogeton spp. growing in the heavily polluted Kokemaenjoki River Estuary, Finland, were: copper in P. perfoliatus (submerged), 39.7; P. obtusifolius (submerged), 44.5; P. natans (floating), 27.1; P. praelongus (submerged), 61.3; and P. gramineus (floating), 20.5. Concentrations of other metals (micrograms per g dry weight) using the same order of plant species were: Zn, 409.7, 190.8, 152.0, 228.9, and 123.8; Mn, 8372.9, 3704.5, 2643.5, 4985.6, and 4820.0; Fe, 3212.1, 5943.9, 1118.1, 9930.0, and 3537.5. Metals levels were much higher than previously reported values for pondweeds in unpolluted waters. Accumulation was species dependent. In general, submerged taxa had higher metals levels than floating-leaved species. The most promising indicator plant was P. perfoliatus, which had very high accumulations of Zn and Mn. (Cassar-FRC)
W83-01392

RECENT INCREASE IN MERCURY SEDIMENTATION IN A FOREST LAKE ATTRIBUTABLE TO PEATLAND DRAINAGE,
Joensuu Univ. (Finland). Karelian Inst.
H. Simola, and M. Lodenius.
Bulletin of Environmental Contamination and Toxicology, Vol 29, No 3, p 298-305, September, 1982. 4 Fig, 1 Tab, 30 Ref.

Descriptors: *Mercury, *Organic matter, *Drainage effects, Fate of pollutants, Lakes, Lake sediment, Sedimentation, Lake Polvijarvi, Lake Paajarvi, *Finland, Peat, Forest watersheds.

Mercury accumulation in sediments of a Finnish Lake increased as a result of draining peatlands and clearing farm fields. Sediment cores were taken from Lake Polvijarvi (eutrophied and surrounded by extensively drained peatland) and Lake Paajarvi (nearly oligotrophic). In Lake Polvijarvi Hg concentrations were: 1864-1920, 0.25 pm (back-

ground); 1967-1975, 0.3-0.5 ppm; and 1976-1980, 0.45 ppm. The profiles of ditching and clearing operations in the Polvijarvi watershed correlated with sidiment accumulation and Hg accumulation. Mobilization of soil Hg was probably the explanation for observed Hg level increases, since industrial and agricultural emissions of Hg were not significant. In Lake Paajarvi Hg concentrations varied from 0.032 to 0.088 ppm, in spite of sediment accumulation rates similar to those of Lake Polvijarvi. However, ditching operations in Paajarvi in the 1960's did not produce clearly noticeable Hg mobilization. Hg mobilization appeared related to the organic matter content of the sediments. Lake Polvijarvi sediments were much higher in organic matter than Lake Paajarvi sediments. On an organic matter basis the Hg concentrations of the two lakes were similar: 0.41-0.73 micrograms per g of organic matter in Lake Paajarvi and 0.50 micrograms per g of organic matter in Lake Polvijarvi (pre-1920's). (Cassar-FRC)
W83-01393

ACCUMULATION OF THE POLYCHLORINATED BIPHENYL AROCLOR 1242 FROM CONTAMINATED DETRITUS AND WATER BY THE SALTMARSH DETRITIVORE, UCA PUGNAX,
Marine Biological Lab., Woods Hole, MA. Ecosystems Center.
A. C. Marinucci, and R. Bartha.
Bulletin of Environmental Contamination and Toxicology, Vol 29, No 3, p 326-333, September, 1982. 3 Fig, 2 Tab, 17 Ref.

Descriptors: *Invertebrates, *Accumulation, *Polychlorinated biphenyls, Fate of pollutants, *Crabs, Detritus, Aroclors, Chlorinated hydrocarbons, Bioaccumulation, Organic compounds, Laboratory studies.

Male fiddler crabs (Uca pugnax) accumulated polychlorinated biphenyls (PCB's) as Aroclor 1242 from detritus at about 1 microgram PCB per day per animal and from water at 0.1 g PCB per day per animal. The detritus contained 17 ng per g wet weight or 85 ng per g dry weight PCB. Uptake of PCB was rapid. By the tenth day of exposure essentially all the PCB had been accumulated (about 8 micrograms PCB per crab). A second feeding at day 20 resulted in a further rapid accumulation to 22 micrograms PCB per crab at day 27. The hepatopancreatic tissue had about 10 times the PCB concentrations of the whole animals and chela tissue. Total PCB accumulation was independent of the weight of the animal, but PCB concentration in the animal was inversely related to animal weight. PCB uptake from water was about half that from detritus plus water after 34 days. (Cassar-FRC)
W83-01394

A STUDY OF WELL WATER IN SELECTED CALIFORNIA COMMUNITIES FOR RESIDUES OF 1,3-DICHLOROPROPENE, CHLOROALLYL ALCOHOL AND 49 ORGANOPHOSPHATE OR CHLORINATED HYDROCARBON PESTICIDES,
California Dept. of Food and Agriculture, Sacramento.
K. T. Maddy, H. R. Fong, J. A. Lowe, D. W. Conrad, and A. S. Frederickson.
Bulletin of Environmental Contamination and Toxicology, Vol 29, No 3, p 354-359, September, 1982. 4 Tab, 7 Ref.

Descriptors: *Pesticide residues, *Organophosphorus pesticides, *Chlorinated hydrocarbons, *Pollutant identification, Insecticides, *California, 1,2-Dichloropropene, Chloroallyl alcohol, Agricultural chemicals, Fate of pollutants.

No pesticide residues were found in water from 54 municipal and private wells (depths 65 to 1200 ft) in the San Joaquin area of California. All wells, in use for 15 or more years, were in an area of high pesticide use. Minimum detectable levels were: 1,3-dichloropropene, 0.1 ppb; chloroallyl alcohol, 0.6 ppb; 27 organophosphates, 5.0 ppb; and 22 chlorinated hydrocarbons, 5.0 ppb. (Cassar-FRC)
W83-01396

5C. Effects Of Pollution

CHRYSOPHYCEAE FROM SOME GREEK LAKES,
Copenhagen Univ. (Denmark). Inst. of Plant Anatomy and Cytology.
J. Kristiansen.
Nova Hedwigia, Vol 33, No 1-2, p 167-194, 1980. 45 Fig, 44 Ref.

Descriptors: *Chrysophyta, *Algae, *Greece, *Lakes, *Subtropic zone, *Spatial distribution, *Population density, Phytoplankton, Hydrobiology, Ochromonas, Diatoms, Climatic zones, Tropic level, Species composition.

Studies were made of the Chrysophyceae of 5 Greek Lakes. Electron microscope evaluations of the species found showed that the lakes examined have very different chrysophycean flora. Lakes Pamvotis, Lysimachia, and to some extent, Lake Ozeros were found to be rich in chrysophyceae, while Lakes Amvrakia and Trichonis were very poor. These differences did not seem to be related to trophic level. Much of the previous work on Chrysophyceae had connected these algae with northern temperature, subarctic and arctic zones. The present investigation clearly indicates an abundance of these algae in Mediterranean climates. Many of the 30 species found during the present study are widely distributed; only 9 species were considered rare. Eight species have been found only in Europe. Since so few Greek lakes have been examined for Chrysophyceae, and only in March-April, it is likely that many more of these algae will be found in further investigations. (Geiger-FRC)
W83-01064

ALGAL GROWTH STIMULUS BY PHOSPHORUS IN FLATHEAD LAKE, MONTANA, SEDIMENTS,
Montana Univ., Flathead Lake. Biological Station.
W. B. Perry, and J. A. Stanford.
Northwest Science, Vol 56, No 1, p 48-52, 1982. 1 Fig, 1 Tab, 15 Ref.

Descriptors: *Sedimentation, *Phosphorus, *Algae, Adsorption, *Oligotrophic lakes, Selenastrum capricornutum, Bioassays, Growth rates, Nutrients, Lakes, Flathead Lake, *Montana, Lake sediments, Bottom sediments.

Sediments from oligotrophic Flathead Lake, Montana, stimulated more than double the growth of Selanastrum capricornutum compared to control cultures to which no sediment was added. Phosphorus, nitrogen, and other nutrients were apparently available to the algae under laboratory conditions. In the lake, growth stimulatic does not occur, because the sediment quickly settles to the bottom (mean depth, 50.2 m) out of contact with the algae in the photic zone. In addition, anaerobic conditions, which favor P release from sediments, do not occur in this lake. Resuspension is confined to near-shore areas. Therefore, clay sediments entering the lake during spring runoff act as a permanent sink for P. (Cassar-FRC)
W83-01065

ZONATION OF INSHORE BENTHOS OFF A SEWAGE OUTFALL IN HAWKE BAY, NEW ZEALAND,
Canterbury Univ., Christchurch (New Zealand). Dept. of Zoology.
G. A. Knox, and G. D. Fenwick.
New Zealand Journal of Marine and Freshwater Research, Vol 15, No 4, p 417-435, 1981. 13 Fig, 5 Tab, 54 Ref.

Descriptors: *Benthos, *Wastewater disposal, *Outfall sewers, Wastewater outfall, Hawke Bay, Bay, Aquatic life, Water pollution effects, Benthic environment, *New Zealand.

A baseline was sought for monitoring changes in the benthos off a sewage outfall in Hawke Bay. The bay is a large shallow waterbody on the east coast of the North Island of New Zealand. At the study site the bottom slopes steadily from about 4 meters to about 17 meters in depth at the outer stations. A strong inflow of water along the mid line of the bay was noted which diverges to flow around the bay's margins. The steep sand-shingle beach in this part of Hawke Bay reflects the importance of wave action in the nearshore environment. Crustacea and Polychaeta contributed most of the 100 species found. Most individuals were polychaetes. Five groups of species were found. Five faunal zones parallel to shore and progressively wider further offshore were distinguished. Community structure increased offshore, and faunal density decreased offshore from the second zone. Inshore zones were obviously polluted, with the capitellid Heteromastus filiformis occurring in densities up to 36,950 per square meter 500 meters from shore. Furthest from shore, the fauna was more normal with Heteromastus densities of 6000 per square meter. Unique to New Zealand shores is a dense zone of holothurians at 8-10 meter depths. Deposit feeders dominated all stations whereas suspension feeders dominated the benthos of coarser sediments. (Baker-FRC)
W83-01085

THE LOCH EIL PROJECT: ASSESSMENT AND SYNTHESIS WITH A DISCUSSION OF CERTAIN BIOLOGICAL QUESTIONS ARISING FROM A STUDY OF THE ORGANIC POLLUTION OF SEDIMENTS,
Dunstaffnage Marine Research Lab., Oban (Scotland).
T. H. Pearson.
Journal of Experimental Marine Biology and Ecology, Vol 57, No 1, p 93-124, 1982. 3 Fig, 8 Tab, 54 Ref.

Descriptors: *Organic matter, *Pulp and paper industry, *Benthic fauna, Water pollution effects, Fjords, Estuaries, Loch Eil, *Scotland, Invertebrates, Sediments, Nutrients, Fate of pollutants, Cellulose, Phytoplankton, Plankton, Sedimentation, Bacteria, Seasonal variation, Biomass.

Results of 11 published studies on the effects of pulp and paper mill effluents on Loch Eil, Scotland, a fjordic system, are summarized. The cellulosic paper mill wastes comprised 67-95% of the total annual carbon input (290 g C per sq m) to the system. Several general conclusions were reached as a result of analyzing the physical, chemical, and biological variables: (1) nutrient regeneration from the sediments plays an important part in stimulating productivity in the water column, (2) organic carbon does not accumulate on a long-term basis, (3) a 10-fold increase in carbon input to the sediments has little effect on bacterial biomass but increases protozoan biomass 100-fold, doubles the small metazoan biomass, and increases macrofaunal biomass, for an overall halving of biomass, (4) macrofauna activities do not control microbial activity levels in sediments under high organic inputs but have a critical effect on microbial systems under low organic input conditions, and (5) perturbations of the ecosystem are temporary in this inherently stable loch system. (Cassar-FRC)
W83-01086

THE LOCH EIL PROJECT: PLANKTONIC PIGMENTS IN SEDIMENTS FROM LOCH EIL AND THE FIRTH OF LORNE,
Dunstaffnage Marine Research Lab., Oban (Scotland).
P. Tett.
Journal of Experimental Marine Biology and Ecology, Vol 56, No 1, p 101-114, 1981. 7 Fig, 2 Tab, 38 Ref.

Descriptors: *Organic matter, *Plant pigments, *Pulp and paper industry, Water pollution effects, Estuaries, Fjords, Loch Eil, Firth of Lorne, *Scotland, Phytoplankton, Sediments, Chlorophyll, Pigments, Anaerobic conditions, Seasonal variation, Sedimentation.

Photosynthetic pigments and their derivatives were determined in sediments collected in Loch Eil and the Firth of Lorne, Scotland, during November 1975 to November 1976. Pigments were separated into two fractions, chlorophyll (chlorophyll a + chlorophyllide a) and phaeopigment, by

fluorescence change on acidification. Highest pigment levels (mean 73 micrograms per g sediment dry weight) and highest percentage of chlorophyll (23%) were found in the most reducing sediments (Eh, +74 mV), which were associated with high organic matter input from a pulp and paper mill discharge. The lowest mean pigment concentrations (23 micrograms per g sediment dry weight) and lowest percentage of chlorophyll (17%) were found in the oxidizing sediments (Eh, +426 mV) in the Firth of Lorne, unaffected by the paper mill wastes. In the Firth of Lorne sediments a seasonal cycle was observed in pigment levels, with maxima in pigment concentrations and chlorophyll % in May-June, directly following the plankton spring increase. In the Loch Eil sediments seasonal cycles of pigment levels were less evident at stations moderately impacted by paper mill effluents. At the most polluted station sediment pigment concentrations varied widely, with no apparent seasonal patterns. The rate of pigment breakdown was lower at polluted stations. There was no correlation between sediment pigment content and the content and sedimentation rate of the phytoplankton pigments in overlying water. (Cassar-FRC)
W83-01087

AEROMONAS HYDROPHILA ENCOUNTERED DURING SURVEY OF LEPTOSPIRAE IN PRAWN FARM POND WATER,
Hawaii State Dept. of Health, Honolulu.
H. H. Higa, T. R. Sawa, V. T. Sato, J. A. Brock, and S. F. Perri.
Journal of Environmental Health, Vol 45, No 1, p 20-23, July/August, 1982. 1 Fig, 2 Tab, 17 Ref.

Descriptors: *Aquaculture, *Aeromonas, *Bacteria, Pathogens, Water pollution sources, *Hawaii, Oahu.

Aeromonas spp. was found in dead hamsters inoculated with water from a prawn aquaculture pond on Oahu, Hawaii. The study had been designed to survey for leptospirae. Of the 576 hamsters in the study, 132 died within 96 hours after inoculation. Examination of 33 of the dead animals revealed Aeromonas spp. in 33.3% of the brains and 100% of the spleens. Aeromonas hydrophila was identified in isolates from 13 of the 33 animals. These organisms pose a potential health threat to prawn pond workers. (Cassar-FRC)
W83-01089

EPIDEMIOLOGY OF ELTOR CHOLERA IN RURAL BANGLADESH: IMPORTANCE OF SURFACE WATER IN TRANSMISSION,
Centers for Disease Control, Atlanta, GA.
J. M. Hughes, J. M. Boyce, R. J. Levine, M. Khan, and K. M. A. Aziz.
Bulletin of the World Health Organization, Vol 60, No 3, p 395-404, 1982. 1 Fig, 9 Tab, 20 Ref.

Descriptors: *Public health, *Epidemiology, *Bacteria, *Cholera, *Bangladesh, Vectors, Disease vectors, Vibrio, Vibrio cholerae.

To define the role of water used for drinking, cooking, bathing, and washing in the transmission of Vibrio cholerae biotype eltor infections in an area with endemic cholera, surveillance was initiated in neighborhoods with a culture-confirmed cholera index case and others with index cases with non-cholera diarrhea as controls. In neighborhoods with cholera infection, 44% of the surface water sources were positive for V. cholerae, whereas only 2% were positive in control neighborhoods. Canals, rivers, and tanks were most frequently positive. An increased risk of infection existed in families using water from culture-positive sources for drinking, cooking, bathing, or washing and for those using water sources used by index families for cooking, drinking, or bathing. For families drinking from a culture negative source, there was an association between infection and bathing in a positive source. These and other data suggested that use of surface water is important in the transmission of V. cholerae and that, in addition to providing safe drinking water, education regarding the risk of transmission of infection by water from potentially contaminated sources used for other purposes, especially bathing, may also be necessary to control transmission in areas where eltor cholera is endemic. (Baker-FRC)
W83-01107

FACTORS AFFECTING THE DISTRIBUTION OF THE BIVALVE, MACOMA BALTHICA (L.) ON A MUDFLAT RECEIVING SEWAGE EFFLUENT, FRASER RIVER ESTUARY, BRITISH COLUMBIA,
E.V.S. Consultants Ltd., Vancouver (British Columbia).
E. R. McGreer.
Marine Environmental Research, Vol 7, No 2, p 131-149, 1982. 5 Fig, 8 Tab, 30 Ref.

Descriptors: *Estuarine environment, *Mollusks, *Wastewater disposal, Effluents, Wastewater treatment, Water treatment facilities, Water pollution sources, Marshes, Fraser River, Mudflats, Intertidal areas, Effects of pollution, Population dynamics, *British Columbia.

An investigation of the factors responsible for the distribution of Macoma balthica (L.) on a mudflat receiving sewage effluent was carried out in the Fraser River estuary, British Columbia. The factors examined included reduced salinity, low levels of dissolved oxygen, effluent toxicity, chlorination, substrate grain size and the effects of metal contaminated sediments. Results showed that salinity, dissolved oxygen and sediment grain size did not satisfactorily explain the distribution of M. balthica. Unchlorinated and chlorinated sewage effluent were shown to be nontoxic in laboratory tests, and these results were confirmed by 7-day in situ bioassays. The factor which appeared to determine the distribution of M. balthica was the degree of contamination of the substrate, which affected the settling and survival of larval and juvenile clams. Heavy metals occurred in high concentrations in the contaminated sediments and were considered to be the most probable controlling factor. (Baker-FRC)
W83-01127

NUTRIENT ENRICHMENT OF SEAGRASS BEDS IN A RHODE ISLAND COASTAL LAGOON,
Rhode Island Univ., Kingston. Dept. of Botany.
M. M. Harlin, and B. Thorne-Miller.
Marine Biology, Vol 65, No 3, p 221-229, 1981. 3 Fig, 9 Tab, 33 Ref.

Descriptors: *Nutrients, *Lagoons, *Sea grasses, Saline lakes, *Rhode Island, Nitrogen, Phosphorus, Algal growth, Coastal lakes, Phytoplankton, Epiphytes, Aquatic weeds, Aquatic plants, Ammonium.

The possibility that adding low concentrations of potentially limiting nutrients in situ could alter the balance of four plant components: seagrasses, seaweeds, epiphytic flora, and phytoplankton, was investigated. Seagrass and algal beds showed a variety of responses when the water column was treated with low level additions of ammonium, nitrate and phosphate. Ammonium caused the production of dense mats of free floating green algae. It also stimulated growth in both the leaf and rootrhizome fractions of Zostera marina, particularly in areas where the current speed reached 12 cm/sec. The concentration of nitrogen in the tissue did not change. Nitrate additions enhanced growth of the green seaweeds Enteromorpha spp. and U. lactuca, but not Z. marina or R. martima. Phosphate enhanced growth in Z. marina and R. maritima exposed to moderate current. G. tikvahiae growing alone showed a small growth response to phoshate. The phosphate made no difference in the growth of the green seaweeds. None of the nutrient supplements noticably altered the species composition of either epiphytic or planktonic algae associated with the beds, although small increases in their numbers were detected. The rapid and dense growth of green algae in nitrogen enriched water probably limited growth of adjacent seagrasses and red algae. Because these seaweeds did not use the phosphate, it became available to other plant components. The overall floral response to nutrient addition in seagrass communities depends on the particular nutrient supplied, the ability of alternate species in the area to compete for that nutrient, and the velocity of current in the specific area. (Baker-FRC)
W83-01129

RESPONSES OF EXPERIMENTAL ESTUARINE COMMUNITIES TO CONTINUOUS CHLORINATION,
Environmental Research Lab., John's Island, SC. Bears Bluff Field Station.
P. F. Sheridan, and A. C. Badger.
Estuarine, Coastal and Shelf Science, Vol. 13, No. 3, p 337-347, September, 1981. 6 Tab, 29 Ref.

Descriptors: *Estuarine environment, *Benthos, *Chlorination, Chlorine, *South Carolina, Estuaries, Plankton, Productivity, Temperature effects, Weather.

The effects of continuous chlorination on estuarine benthic organisms were investigated using plankton derived experimental communities. Twelve consecutive studies were conducted, each of which consisted of about 60 day colonization periods from flowing estuarine waters that continuously received nominal concentrations of 0.00, 0.47, 0.94 or 1.41 mg chlorine-produced oxidant (CPO)/liter. Chlorination had an inconsistent impact on the colonization and development of estuarine communities. Short-term seasonal effects occurred sporadically, but included elimination of dominant species (Molgula, Ampharete), replacement of one dominant species by another (Melita by Pista or Pista by Nereis), and the interaction of extreme cold weather with chlorination to produce higher toxicity. Analysis of the pooled data from 12 consecutive studies showed no chlorination effects on numbers of species recorded and only two species whose proportional contributions to the total faunas were significantly reduced by chlorination. A general decline in the total numbers of individuals recorded was caused by chlorination. The findings of inconsistent chlorination impact may be due to several factors, including small numbers of colonizing organisms, short colonization periods and water quality parameters such as salinity, ammonia content and entrained organics which were not controlled. There was a lack of a linear or gradient response by developing communities to increasing CPO levels. Instead, an abrupt 38 to 44% decline in numbers was noted in chlorinated systems as compared to controls. (Baker-FRC)
W83-01131

AVON-HEATHCOTE, ESTUARY UNDER STRESS,
Canterbury Univ., Christchurch (New Zealand). Dept. of Zoology.
For primary bibliographic entry see Field 5B.
W83-01149

PRIMARY PRODUCTION IN A TURBID ESTUARY,
Institute for Marine Environmental Research, Plymouth (England).
For primary bibliographic entry see Field 2L.
W83-01155

EFFECTS OF RESIDENTIAL WASTEWATER-TREATMENT SYSTEMS ON GROUNDWATER QUALITY IN WEST-CENTRAL JEFFERSON COUNTY, COLORADO,
Geological Survey, Lakewood, CO. Water Resources Div.
D. C. Hall, D. E. Hillier, E. Nickum, and W. G. Dorrance.
Geological Survey Open-File Report 81-73 (WRI), 1981. 65 p, 8 Fig, 19 Tab, 70 Ref.

Descriptors: *Groundwater, *Water quality, *Water pollution effects, *Septic tanks, Aquifers, Aerobic treatment, Effluents, Degradation, Nitrates, Chemical analysis, Well data, Observation wells, Sites, *Colorado, Jefferson County.

The use of residential wastewater-treatment systems in Evergreen Meadows, Marshdale, and Herzman Mesa, Colo., has degraded ground-water quality to some extent in each community. Age of

community; average lot size; slope of land surface; composition, permeability, and thickness of surficial material; density, size, and orientation of fractures; maintenance of wastewater-treatment systems; and presence of animals are factors possibly contributing to the degradation of ground-water quality. When compared with effluent from aeration-treatment tanks, effluent fom septic-treatment tanks is characterized by greater biochemical oxygen demand and greater concentrations of detergents. When compared with effluent from septic-treatment tanks, effluent from aeration-treatment tanks is characterized by greater concentrations of dissolved oxygen, nitrite, nitrate, sulfate, and dissolved solids. (USGS)
W83-01182

EFFECT OF ELEVATED WATER TEMPERATURE ON MACROINVERTEBRATE COMMUNITIES IN OUTDOOR EXPERIMENTAL CHANNELS,
Environmental Protection Agency, Monticello, MN. Ecological Research Station.
J. W. Arthur, J. A. Zischke, and G. L. Ericksen.
Water Research, Vol 16, No 10, p 1465-1477, October, 1982. 8 fig, 3 Tab, 24 Ref.

Descriptors: *Temperature effects, *Macroinvertebrates, *Population dynamics, Physical properties, Seasonal variation, Channels, Powerplants, Heated water, Thermal pollution, *Mississippi River, Minnesota.

Macroinvertebrates were sampled monthly from December 1976 to September 1977 in two 520 m long outdoor experimental channels. One channel was maintained at ambient seasonal Mississippi River water temperatures and the other at 10 C higher. Maximum water temperature reached 31.0 C in the ambient and 40.8 C in the heated channel. Elevated temperature seasonally altered macroinvertebrate abundance and life history in the channels. Few animals were found in the heated channel during the period of maximum water temperature. Most macroinvertebrate density and composition differences were confined to the channel riffles rather than the pools. Peak total density in the heated channel riffles occurred 3 or 4 weeks before the ambient channel. Total macroinvertebrate density was appreciably higher in the heated channel riffles during the winder and spring months and in the ambient channel riffles during the summer months. This seasonal alteration was due to composition differences of several identified taxa. Reproductive periods for one snail and one isopod species began about 2 and 3 months earlier respectively in the heated channel than in the ambient channel. No marked change occurred in the reproductive activities of an amphipod in the two channels. (Baker-FRC)
W83-01195

SIMPLE TROPHIC STATE CLASSIFICATION OF THE CANADIAN NEARSHORE WATERS OF THE GREAT LAKES,
Canada Centre for Inland Water, Burlington (Ontario).
D. J. Gregor, and W. Rast.
Water Resources Bulletin, Vol 18, No 4, p 565-573, August, 1982. 4 Fig, 3 Tab, 25 Ref.

Descriptors: *Water quality, *Great Lakes, *Nearshore processes, *Trophic level, *Phosphorus, *Nutrients, *Chlorophyll a, *Mathematical studies, Impaired water quality, Water pollution, Eutrophication, Lakes, Oligotrophy, Turbidity, Opacity, *Lake classification, *Composite Trophic Index, Indicators, Bioindicators.

A trophic classification of the Canadian nearshore waters of the Great Lakes was carried out utilizing data on summer surface water quality for the early 1970's. A general Composite Trophic Index was generated using paired linear relationships for total phosphorus, chlorophyll a, and Secchi depth data for 66 defined regions. Nearshore waters were found to contain a lower chlorophyll a concentration for a given total phosphorus concentration than observed for the open water areas of the Great Lakes or for smaller Canadian lakes. The most eutrophic conditions were found in areas of restricted circulation and/or high nutrient loading such as the Bay of Quinte, Toronto, Hamilton harbors, and parts of the western basin of Lake Erie. Except for some embayments, Lakes Huron and Superior are mostly oligotrophic. The Composite Trophic Index eliminates biases introduced through the use of a single trophic state indicator and is useful in describing nearshore water quality in terms generally comparable to other water bodies. (Geiger-FRC)
W83-01199

PATHOGENIC AMOEBAE IN OCEAN SEDIMENTS NEAR WASTEWATER SLUDGE DISPOSAL SITES,
National Marine Fisheries Service, Oxford, MD.
T. K. Sawyer, E. J. Lewis, M. Galassa, D. W.. Lear, and M. L. O'Malley.
Journal of the Water Pollution Control Federation, Vol 54, No 9, p 1318-1323, September, 1982. 2 Fig, 3 Tab, 21 Ref.

Descriptors: *Amebas, *Marine sediments, *Sludge disposal, Pathogens, Ocean dumping, Sediments, Fate of pollutants, Disposal, *Middle Atlantic Bight, Microorganisms, Bacteria, Parasites, Coliforms, Indicators.

Acanthamoeba species were found in 17.5% of 229 ocean bottom sediment samples collected in the vicinity of the Philadelphia-Camden wastewater sludge disposal site, 64 km seaward from Maryland, between April 1978 and August 1980. Amebas were distributed 37-40 km northeast and southwest of the dumpsite center and 10 km to the east and west. 50-75% of sediment samples containing coliforms and streptococci also contained amebas, indicating a similar distribution pattern for bacteria and amebas. Two of the 6 ameba species, A. culbertsoni and A. hatchetti, killed laboratory mice. A. hatchetti was found at 17 stations and A. culbertsoni at 2. A. polyphaga (found at 14 stations), A. castellanii, A. rhysodes, and A. triangularis are not considered pathogenic. (Cassar-FRC)
W83-01216

ACID DEPOSITION,
B. Hileman.
Environmental Science and Technology, Vol 16, No 6, p 323A 327A, June 1982. 4 Fig.

Descriptors: *Acid rain, *Lakes, *Sulfur compounds, *Path of pollutants, Pollutants, Water quality, Water properties, Fish, Aquatic animals, Bioindicators, Geography, Hydrogen ion concentration, Forests, Leaching, Seepage, Sucker, Trout, Minnow, Precipitation, Rainfall, Chemistry of precipitation.

Papers presented at the American Chemical Society's symposium on acid precipitation (March 29 to April 2, 1982) are summarized. It was shown that a pH isopleth of 4.5 encloses an area of the U.S. and Canada that is in general symmetrical about and displaced somewhat to the northeast of states with high sulfur dioxide emissions. Across the north central lake states the acidity concentration gradient is almost the same as that which existed in Scandinavia when lakes there became acidified. The extent of injury caused by acid rain in lakes is much greater than the killing of fish, and other negative effects precede fish disappearnce. A study of about 2,000 observations on the tolerance of aquatic organisms to acidity revealed that fish and amphibians are the most tolerant and leeches and mollusks the least. Experimental acidification of a small precambrian shield lake showed that fathead minnows died out first at a pH of about 5.5, while lake trout and white suckers showed no stress till pH of about 5.1. In 12 seepage lakes, 6 of which were acidic, species richness of fish was much less in the acidic lakes, and minnows were significantly fewer here. In surface waters a reduction in pH is accompanied by high manganese concentrations and indicates the release of other heavy metals into the water. Increased manganese and aluminum concentrations were found in fish in acidified lakes. Some models for water chemistry were presented, but as yet these tend to describe an existing state rather than to predict what acid inputs would cause a given change in chemistry. Several papers were given on the chemical processes of acidification of precipitation and on long-range transport. (Gish-FRC)
W83-01217

POTENTIAL EUTROPHICATION OF THE RIDEAU RIVER BY AN URBAN WATERWAY: DISCUSSION,
Gore and Storrie Ltd., Toronto (Ontario).
M. D. Palmer.
Canadian Journal of Civil Engineering, Vol 9, No 2, p 353-356, June, 1982. 3 Fig, 19 Ref.

Descriptors: *Eutrophication, *Rivers, *Nutrients, Temperature effects, Sawmill Creek, Rideau River, Storm runoff, Phosphorus, Urban watersheds, Seasonal variation, Nitrogen, *Ontario.

In a paper published in Canadian Journal of Civil Engineering, Vol. 8, p 165-172, M. H. Habicht, K. Adamowski and A. C. Middleton attempted to ascertain whether nutrients contributed by Sawmill Creek can exert a significant effect on algal growth in the Rideau River. Total phosphorus and total nitrogen concentrations were measured in Sawmill Creek, a major Rideau River tributary, during storm events, and similar measurements were made in the receiving stream upstream from tributary outlet. Jar growth algae tests were carried out in the laboratory, wherein various strengths of tributary water were mixed with the receiving water. The algal biomasses in the jars after 6 days were tested statistically. The tributary water significantly increased the biomass in the jars. The present author points out that river flow data for the Rideau River are very complex and are largely controlled by an upstream dam at Hog's Back. Potential eutrophication is probably a function of loading rate and flushing times, not simply of concentrations. It is also probable that physical mixing (turbulence), turbidity, and resuspension are factors for stormwater. Sediment exchange processes are important when considering total phosphorus budgets. Measurements in the Rideau River show Secchi disc values of 0.5-2.2 m and an attenuation coefficient using a submerged submarine photometer of 2.1/m. According to these data, it appears probable that light limitation is a factor in the eutrophication of the River. The normal low river velocities during summer, averaging between 4 and 6 cm/sec, would suggest that physical mixing is not a factor during these dry periods. Sawmill Creek water is invariably colder than Rideau River water, which may account for the lower nutrient stormwater concentrations found. Consequently, stormwater will sink in the Rideau River, and river mixing will be a factor in the total phosphorus storm loadings from Sawmill Creek to the Rideau River. (Baker-FRC)
W83-01219

PHYTOPLANKTON COMPOSITION AND DISTRIBUTION AS AN EXPRESSION OF PROPERTIES OF RESERVOIRS,
Barcelona Univ. (Spain). Dept. of Ecologia.
For primary bibliographic entry see Field 2H.
W83-01224

FATE OF POLYCHLORINATED BIPHENYLS (PCBS) IN SOIL PLANT SYSTEMS,
North Carolina State Univ. at Raleigh. Dept. of Biological and Agricultural Engineering.
For primary bibliographic entry see Field 5B.
W83-01235

EFFECTS OF A HEXACHLOROBIPHENYL AND PENTACHLOROPHENOL ON GROWTH AND PHOTOSYNTHESIS OF PHYTOPLANKTON,
New York State Dept. of Health, Albany. Environmental Health Center.
I. J. Gotham, and G. Y. Rhee.
Journal of Great Lakes Research, Vol. 8, No. 2, p 328-335, 1982. 6 Fig, 29 Ref.

Descriptors: *Chlorinated hydrocarbons, *Phytoplankton, *Photosynthesis, *Growth rates, *Hexachlorobiphenyl, Pentachloropheno, *Phenols, Organic compounds, Water pollution effects, Fate of

pollutants, Accumulation, Bioaccumulation, Algae, Inhibition, *Ankistrodesmus falcatus, *Melosira, *Microcystis, Lake Huron, Great Lakes.

The effects of two organochlorine compounds, 2,4,5,2',2',5'-hexachlorobiphenyl (HCB) and pentachlorophenol (PCP), on algal photosynthesis and growth were studied in semicontinuous cultures of Ankistrodesmus falcatus, Melosira sp., and Microcystis sp. Concentrations were: HCB, 0.5-1.0 micrograms per liter; PCP, 1.0-1.3 micrograms per liter. HCB stimulated photosynthesis in Ankistrodesmus and Melsosira, both per cell and per unit of chlorophyll. Average cell concentrations of HCB were 3 times 10 to the minus 5th power and 6 times 10 to the minus 6th power ng per cell, respectively. HCB significantly inhibited the growth rate of Melosira, but no trend in Ankistrodesmus growth was apparent. HCB was not tested on Microcystis. PCP inhibited photosynthesis in Ankistrodesmus and Microcystis, both per cell and per unit of chlorophyll. Cell concentrations of PCP were 4-8 times 10 to the minus 7th power and 2-11 times 10 to the minus 8th power ng per cell, respectively. PCP inhjibited phjotosynthesis in Melosira at 2-6 times 10 to the minus 7th power ng per cell. Melosira growth rates were significantly depressed by PCP. Growth rates of Ankistrodesmus and Microcystis in PCP showed no statistical trends. (Cassar-FRC)
W83-01242

OVERVIEW OF PHYTOPLANKTON CONTAMINANT PROBLEMS,
New York State Dept. of Health, Albany. Environmental Health Center.
For primary bibliographic entry see Field 5B.
W83-01243

FIELD AND LABORATORY STUDIES OF THE TOXICITY OF PHYTOPLANKTON OF POLYCHLORINATED BIPHENYLS (PCBS) DESORBED FROM FINE CLAYS AND NATURAL SUSPENDED PARTICULATES,
Oak Ridge National Lab., TN. Environmental Sciences Div.
C. D. Powers, G. M. Nau-Ritter, R. G. Rowland, and C. F. Wurster.
Journal of Great Lakes Research, Vol. 8, No. 2, p 350-357, 1982. 4 Fig, 2 Tab, 32 Ref.

Descriptors: *Phytoplankton, *Polychlorinated biphenyls, *Sediments, Adsorption, Water pollution effects, *Toxicity, Sediments, *Aroclors, Chlorinated hydrocarbons, *Clays, Particulate matter, *Suspended sediments, Photosynthesis, Chlorophyll a, Diatoms, Algae, New York Bight.

Particulates with adsorbed polychlorinated biphenyls (PCB's), as Aroclor 1254, released enough toxic substance upon description in the presence of diatoms and natural phytoplankton assemblages to adversely affect photosynthesis, growth rates, and chlorophyll a levels. Laboratory studies used illite and New York Bight sediment treated with C14-labelled Aroclor 1254 and two diatom cultures, Thalassiosira pseudonana and T. weissflogii. Field studies in dialysis bags suspended in the tidal channel of an estuarine marsh used Hudson River particulates and natural phytoplankton assemblage. The cultures containing 90 micograms per liter of illite-bound PCB were heavily damaged within 4 hours, by which time 72% of the PCB had desorbed from the clay and dissolved in the water. When PCB-containing particles were removed after equilibration with water and before addition of algae, enough dissolved PCB remained in the water to reduce growth rates and chlorophyll a content of the culture. In the field test (50 micrograms per liter of sediment-associated PCB) photosynthesis and chlorophyll a were adversely affected for 3 days. (Cassar-FRC)
W83-01244

EFFECTS OF SURFACE FILMS ON AIR-WATER EXCHANGE RATES,
Toronto Univ. (Ontario). Dept. of Chemical Engineering and Applied Chemistry.
D. Mackay.
Journal of Great Lakes Research, Vol 8, No 2, p 299-306, 1982. 3 Fig, 2 Tab, 20 Ref.

Descriptors: *Air-water interfaces, *Films, *Volatility, Model studies, *Organic compounds, Mass transfer, Surface films, Hydrodynamics, Diffusivity, Fate of pollutants, Waves, Resistance, Evaporation.

A model for describing the effects of surface films (in particular, organic contaminants) on the rate of air-water exchange is based on two additive retarding effects. The hydrodynamic effect, which slows turbulence, is identified by changes in drag coefficient, friction velocity, and surface roughness. The diffusive resistance effect depends on the diffusivities or mass transfer coefficients of water, film, and air and the fugacity capacities. The model results aagreed with experimental data. However, further testing is necessary for films of different thickness and known composition using solutes covering a range of fugacity capacities. The model describes only diffusive transfer and does not consider spray transfer or wet and dry deposition. (Cassar-FRC)
W83-01262

SHORT CYCLING OF CONTAMINANTS BY ZOOPLANKTON AND THEIR IMPACT ON GREAT LAKES ECOSYSTEMS,
Minnesota Univ., Minneapolis. Dept. of Ecology and Behavioral Biology.
For primary bibliographic entry see Field 5B.
W83-01263

EVALUATION OF MICROCOSMS FOR DETERMINING THE FATE AND EFFECT OF BENZ(A)ANTHRACENE IN AQUATIC SYSTEMS,
Utah Water Research Lab., Logan.
For primary bibliographic entry see Field 5B.
W83-01282

RIVER WATER QUALITY FOR BATHING PURPOSES,
Benaras Hindu Univ., Varanasi (India). Inst. of Tech.
M. S. Narayanaswamy.
Journal of the Institution of Engineers (India), Part EN, Environmental Engineering Division, Vol. 62, No. 2, p 59-63, February, 1982. 1 Tab, 27 Ref.

Descriptors: *Water quality, Bacteria, *Bathing, *India, Public Health, Coliforms, Wastewater disposal, Wastewater treatment, Path of pollutants.

Community bathing in rivers, as a traditional religious activity, is indispensable to the people of India. Public health risks are involved for those who bathe in the rivers polluted due to discharge of untreated or partially treated domestic sewage. The primary concern is caused by the presence of pathogens. Their numbers decrease in the natural aquatic environment due to several physico-chemical and biological factors. However, the bacteria Salmonella typhi survives for one to four days in raw river waters and two days in drainage canals. The Indian Standards Institution should reconsider its standard for bathing quality of river waters. Realistic, acceptable standards can only be developed by collecting data through organized research, including environmental and epidemiological parameters. (Baker-FRC)
W83-01320

RECENT INVESTIGATIONS ON THE EUTROPHICATION AND RESTORATION OF LAKE CONSTANCE (NEUERE UNTERSUCHUNGEN UBER DIE EUTROPHIERUNG UND SANIERUNG DES BODENSEES),
Konstanz Univ. (Germany, F. R.) Limnology Inst.
For primary bibliographic entry see Field 5G.
W83-01321

ACUTE FLUORIDE POISONING ASSOCIATED WITH AN ON-SITE FLUORIDATOR IN A VERMONT ELEMENTARY SCHOOL,
Vermont State Dept. of Health, Burlington.
R. L. Vogt, L. Witherell, D. LaRue, and D. N. Klaucke.
American Journal of Public Health, Vol 72, No 10, p 1168-1169, October, 1982. 1 Fig, 9 Ref.

Descriptors: *Public health, *Drinking water, *Fluoridation, Water pollution effects, Water pollution sources, Contamination, Human diseases, Water treatment, Vermont.

An outbreak of minor illnesses consisting of nausea and vomiting occurred on August 30, 1980 among individuals attending a farmers' market at a school in Vermont. A total of 22 persons were stricken. Illness was associated with the consumption of beverages made from school water. Analysis of the water indicated high levels of fluoride (1.041 mg/l). The most likely source of the contamination was the school fluoridator, which had accidentally been left on continuous operation. While the benefits of fluoridation for dental health are significant, public health officials are encouraged to lessen the possibilities of excess exposure by inspecting systems regularly and installing equipment which can protect against the consumption of high fluoride concentrations. (Baker-FRC)
W83-01329

A PILOT STUDY OF POTENTIAL PHENOLIC CONTAMINATION OF FISHES IN THE COLUMBIA RIVER AND TRIBUTARIES IN THE VICINITY OF MOUNT ST. HELENS,
Beak Consultants, Inc., Portland, OR.
K. P. Campbell, S. R. Johnson, and K. U. Wolniakowski.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-146357, Prices codes: A03 in paper copy, A01 in microfiche. Final Report, June 1982. 28 p, 1 Fig, 1 Tab, 14 Ref, 1 Append. OWRT-C-10072-V(1462)(1).

Descriptors: *Phenols, *Pentachlorophenol, *Fish, *Water pollution effects, *Volcanoes, *Mount St. Helens, Sediments, Salmon, Trout, Sturgeon, *Washington, Columbia River, Spirit Lake, Toutle River, Cowlitz River, Pollutant identification, Gas chromatography.

Following the eruption of Mount St. Helens on 18 May 1980, high levels of phenols were reported in water and sediments from Spirit Lake, the Toutle River, Cowlitz River and Columbia River. The potential for phenolic contamination in fish flesh from these waters was investigated by analysis of fish muscle samples. Analysis was by flame ionization detector gas chromatography on an extract of the muscle tissue. Confirmation of compound identity was by analysis of a pentafluorobenzyl derivative of the extract using the gas chromatography mated to an electron capture detector. Further confirmation of some samples was by gas chromatography/mass spectrometry. Water, sediment and soil samples were analyzed similarly. Phenol was found in three specimens: white sturgeon and coho salmon from the Columbia River, and sea-run cutthroat trout from the mouth of the Cowlitz River, with concentrations ranging from 26 to 56 ng/g. Pentachlorophenol was confirmed in 11 samples with concentrations ranging from 75 ng/g to 324 ng/g. These specimens consisted of eulachon from the Cowlitz River and salmonids from Deer Creek, a tributary of the North Fork Toutle River in the area affected by the mud flow. No pentachlorophenol was detected in water from either location. The presence of phenol at the levels reported is not a cause for concern. It is possible that the phenol originated either from industrial or natural sources. The reported levels of pentachlorophenol could potentially affect taste, but they are not a cause for concern relating to toxicity. (Moore-SRC)
W83-01354

ENVIRONMENTAL FACTORS PROMOTING AND REGULATING N2 FIXING BLUE-GREEN ALGAL BLOOMS IN THE CHOWAN RIVER, NC,
North Carolina Univ. at Morehead City. Inst. of Marine Sciences.
H. W. Paerl.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-146381, Prices codes: A04 in paper copy, AO1 in microfiche. Water Resources Research Institute of the University of North Carolina, Raleigh, Report No 176, January 1982. 74 p, 24 Fig, 9 Tab, 64 Ref. OWRT B-127-NC(4), 14-34-0001-0274.

Descriptors: *Eutrophication, *Cyanophyta, *Phosphorus, *Nitrogen, *Pulp wastes, *Color, *Salinity, *Water pollution effects, Diatoms, Chlorophyta, Seasonal variation, Orthophosphates, Dissolved oxygen, Industrial wastewater, Effluents, Photosynthesis, *North Carolina, Chowan River, *Nitrogen fixing bacteria.

Primary productivity, nitrogen fixation and the physical-chemical parameters regulating these processes, were examined in situ at a location in the lower Chowan River previously known to support blooms. During 1980 periods of weak thermal stratification, particularly during warming periods, coupled with phosphorus sufficiency, were crucial to nitrogen fixing blue-green algal bloom development. Phosphorus sufficiency could be established at relatively low ambient orthophosphate levels. Indirectly, nitrogen sufficiency was important as well. Spring diatom and green algal blooms relied heavily on nitrogenous nutrients (nitrate aand ammonia) for maximum development; the degree of spring bloom development was related to the potential for subsequent deoxygenation of river sediments and overlying water during warm, weakly stratified summer periods. Maximum deoxygenation was usually coupled with maximum blue-green algal bloom development. Pulp mill effluent, which was a highly significant water mass during the drought year 1981, showed negative effects on photosynthetic production, both through strong coloration of waters, thereby restricting transmission of photosynthetically active radiation, as well as chemically inhibiting growth. The chemical inhibition affected non blue-green algal growth more severely than blue-green algal growth. It appears that humic loading (due to pulp mill effluent) may potentially favor blue-green algal over more desirable diatom and green algal species, since blue-green algae can form surface scums and can counter growth inhibition due to humic chelation of essential trace metals. Salinity increases, observed during the drought of 1981, were strong deterrents to blue-green algal bloom formation during the summer months. (Moore-SRC)
W83-01357

THERMOPHILLIC AND THERMOTOLERANT FUNGI ISOLATED FROM THE THERMAL EFFLUENT OF NUCLEAR POWER GENERATING REACTORS: DISPERSAL OF HUMAN OPPORTUNISTIC AND VETERINARY PATHOGENIC FUNGI,
Chicago Univ., IL. Dept. of Medicine.
J. W. Rippon, R. Gerhold, and M. Heath.
Mycopathlogia, Vol 70, No 3, p 169-179, March, 1980. 1 Fig, 13 Tab, 22 Ref.

Descriptors: *Thermal pollution, *Fungi, *Nuclear powerplants, Powerplants, Heated water, Water pollution effects, Temperature effects.

Samples of water, foam, microbial mat, soil and air were obtained over a period of a year from areas associated with the cooling canal of a nuclear power station. The seventeen sample sites included water in the cooling canal that was thermally enriched and soil and water adjacent to, upstream, downstream and at a distance from the generator. Fifty-two species of thermotolerant and thermophilic fungi were isolated. Eleven of these are grouped as opportunistic Mucorales or opportunistic Aspergillus sp. One veterinary pathogen, Dactylaria gallopava, was also isolated. The opportunistic/pathogenic fungi were primarily found in the intake bay, the discharge bay and the cooling canal. Smaller numbers were obtained at both upstream and downstream locations. Soil samples near the cooling canal reflected enrichments of thermophilous organisms. Their numbers were greater than usual in a mesophilic environment. The findings suggest that there was no significant dissemination of thermophilous fungi from the thermal enrichment effluents to the adjacent environment. (Baker-FRC)
W83-01375

SHIFTS IN CADDISFLY SPECIES COMPOSITION IN SACRAMENTO RIVER INVERTEBRATE COMMUNITIES IN THE PRESENCE OF HEAVY METAL CONTAMINATION,
Institute of Paper Chemistry, Appleton, WI.
E. F. Zanella.
Bulletin of Environmental Contamination and Toxicology, Vol 29, No 3, p 306-312, September, 1982. 2 Fig, 3 Tab, 7 Ref.

Descriptors: *Caddisflies, *Heavy metals, *Species composition, Water pollution effects, Invertebrates, Sacramento River, *California, Metals, Zinc, Cadmium, Copper, Larvae, Brachycentrus, Hydropsyche, Toxicity.

Long-term monitoring (18 years) of caddisfly species in the Sacramento River, California, revealed a change in dominance from Brachycentrus americanus to Hydropsyche sp. beginning in 1972. By 1978 there were 900 Hydropsyche per sq ft and about 20 Brachcentrus per sq ft. The changes were related to increases in heavy metals during the monitoring period. Mean values from Cu and Zn in river water were higher in 1979 than in 1976. In 1980 caddisfly larvae contained more Cd, 4 times as much Zn, and less Cu than in 1976. Hydropsyche generally had higher metals levels than Bracyentrus. The changes in caddisfly larvae numbers were attributed to a difference in susceptibility to metals between the two invertebrates. (Cassar-FRC)
W83-01382

EFFECT OF SUSPENDED SEDIMENT ON FEEDING BY LARVAL HERRING (CLUPEA HARENGUS HARENGUS L.),
Department of Fisheries and Oceans, St. Andrews (New Brunswick).
D. D. Johnston, and D. J. Wildish.
Bulletin of Environmental Contamination and Toxicology, Vol 29, No 3, p 261-267, September, 1982. 4 Fig, 2 Tab, 7 Ref.

Descriptors: .*Suspended sediments, *Feeding rates, *Fish food organisms, Sediments, *Herring, *Larvae, Predation, Light intensity, Dredging, Growth stages, Water pollution effects.

Herring larvae were fed Artemia nauplii and wild zooplankton under various conditions of suspended sediment conditions (0, 4, 8, and 20 mg per liter) and light intensity (65, 105, and 300 lux). Significantly fewer food organisms were consumed at 20 mg per liter suspended sediments and at 65 and 105 lux than at the lower suspended sediment levels and control light intensity (300 lux). Smaller larvae consumed fewer Artemia in the presence of suspended sediments and decreased light intensity than the larger larvae. These findings, consistent with the hypothesis that suspended sediments inhibit feeding by interference with vision, suggest that dumping and dredging activities should be stopped during and immediately after spawning. (Cassar-FRC)
W83-01383

THE EFFECTS OF RECREATION ON FRESHWATER PLANTS AND ANIMALS: A REVIEW,
Griffith Univ., Nathan (Australia). School of Australian Environmental Studies.
M. J. Liddle, and H. R. A. Scorgie.
Biological Conservation, Vol 17, No 3, p 183-206, April, 1980. 9 Fig, 3 Tab, 61 Ref.

Descriptors: *Water pollution effects, *Recreation wastes, *Reviews, *Aquatic plants, *Aquatic animals, Environmental effects, Ecological effects, Boating, Camping, Fishing, Swimming, Hunting, *Great Britain.

The impacts of recreation on the freshwater plants and animals of Great Britain are reviewed. The effects of water-based recreation are caused mainly by boaters and include wash, turbulence, turbidity, propeller action, direct contact, disturbance to animals, and pollution from outboard motors and sewage. The effects of shore-based activities such as angling and swimming include trampling, sewage and other chemical impacts. Aquatic herbicides are often used to control weeds that interfere with water-based recreational activities. The release of chemicals from the painted hulls of boats, fishermen's bait and lead weights, the bodies of swimmers, and lead shot from the guns of hunters may also pose a threat to wildlife. The ability of recreation management to minimize some of these impacts is considered. Some recommendations for further research into the effects of recreational activities on freshwater animals and plants are discussed. (Geiger-FRC)
W83-01390

5D. Waste Treatment Processes

NEW AERATION SYSTEM CUTS WASTE TREATMENT COSTS AT BADGER PAPER,
Badger Paper Mills, Inc., Peshtigo, WI.
R. Kinzel, and J. Spellane.
Pulp and Paper, Vol 56, No 7, p 102-104, July, 1982. 3 Fig.

Descriptors: *Wastewater treatment, *Pulp and paper industry, *Aeration, Oxidation, Biochemical oxygen demand, Suspended soldis, Oxygen, Oxygen demand, Sludge, *Wisconsin.

The Badger Mills complex is an integrated 110-tpd, ammonium-base sulfite mill that uses furnish comprised of spruce, balsam, hemlock, and aspen. The mill's waste treatment plant is shared with the town of Peshtigo. Pulping generates an average monthly waste loading of 20000 lb/day of BOD, with a maximum rate of 40,000 lb/day. Some 95% of the load on the treatment plant is industrial; 5% is municipal. Treated waste can be discharged into the Peshtigo River with an allowable BOD of 2302 lb/day and a total suspended solids of 3530 lb/day, based on monthly average. A BOD of 600 lb/day and TSS of 1400 lb/day is typical of that actually discharged. The treatment plant is a gravity type continuous flow through system. Pulp mill waste and municipal waste are collected at a central metering station. Continuous overflow from the basins feeds three 80ft clarifiers operating in parallel. The sludge goes to a pumping station where part of the settled sludge is recycled to the head works and excess waste-activated sludge is sent to a 40-ft sludge thickener. Clarified effluent overflow passes to a chlorine chamber and is then discharged into the Peshtigo River. Thickened sludge is dewatered on a twin-wire filter press and transported to an on-site landfill area. Press filtrate is recycled to the head works. A new space and cost saving aeration system is described. The system is a single-stage BOD removal arrangement that results in capital and operating cost savings. In this system oxygen transfer takes place by molecular diffusion through the interface films between fine air bubbles and process liquor. (Baker-FRC)
W83-01062

CONTROL BY ALKALINE NEUTRALIZATION OF TRACE ELEMENTS IN ACIDIC COAL CLEANING WASTE LEACHATES,
Los Alamos National Lab., NM.
For primary bibliographic entry see Field 5G.
W83-01075

EQUILIBRIUM DISTRIBUTION COEFFICIENTS FOR EXTRACTION OF CHLORINATED HYDROCARBONS AND AROMATICS FROM WATER INTO UNDECANE,
California Univ., Berkeley. Dept. of Chemical Engineering.
T. A. Barbari, and C. J. King.
Environmental Science and Technology, Vol 16, No 9, p 624-627, 1982. 3 Tab, 7 Ref.

Descriptors: *Wastewater treatment, *Solvent extraction, *Organic compounds, Kerosene, *Undecane, Water pollution sources, Water quality control, Aromatic compounds, Hydrocarbons, *Chlorinated hydrocarbons.

Attempts were made to measure equilibrium distribution coefficients between undecane and water for a number or organic solutes contained on the priority pollutant list of the US EPA. Since undecane is a reasonable model of kerosene, the distribution coefficients are useful for evaluation of solvent extraction into kerosene. Solutes included chlorinated hydrocarbons, aromatics, bromoform, and 2-chlorophenol. Highly dilute solutions were

used, and analyses were carried out by flame ionization and electron-capture gas chromatography. The measured distribution coefficients were large enough to make extraction worthy of serious thought as a broad-brush process for removing such compounds from effluent waters. The measured distribution coefficients are also in line with reported solubilities in water. Distribution coefficients into undecane may be explained qualitatively in comparison with reported distribution coefficients into 1-octanol, through hydrogen-bonding concepts. (Baker-FRC)
W83-01076

DYNAMICS OF BIOFILM PROCESSES,
Nalco Chemical Co., Naperville, IL.
M. G. Trulear, and W. G. Characklis.
Journal of the Water Pollution Control Federation, Vol 54, No 9, p 1288-1301, September, 1982. 21 Fig, 5 Tab, 36 Ref.

Descriptors: *Biomass, *Accumulation, *Films, *Biofilms, *Wastewater treatment, *Water treatment, Water distribution, Biological treatment, Microorganisms, Friction loss, Glucose, Kinetics, Cooling towers, Condensers, Energy loss, Fluid flow, Shear, Flow velocity, Mass transfer.

The effects of substrate loading and fluid velocity on biofilm accumulation were studied in a laboratory annular reactor. Although biofilms have a useful function in treatment of wastewater, drinking water, and streamwater, they cause energy losses, reduced efficiency, and decreased water quality in condensers, cooling towers, and water distribution systems. Nutrients and glucose were added to water in the reactor to promote biofilm growth. Material balance relationships were developed to analyze the processes contributing to biofilm formation. Rate expressions, dependent on reactor substrate concentrations, and biofilm mass, were described for rates of glucose removal, biofilm accumulation, and biofilm detachment. Biofilm accumulation was the difference between production (from metabolic growth) and detachment (from fluid shear). Glucose removal was directly proportional to the active biofilm thickness, corresponding to the depth of glucose penetration into the film. Increased glucose concentrations in the substrate increased the depth of glucose penetration. At low fluid velocities glucose removal was limited by the slow transfer of glucose from liquid to fluid-biofilm interface. The ratio and extent of biofilm accumulation increased with increasing glucose loading rate, increased with fluid velocity at low velocities, and decreased with increasing fluid velocity at high velocities. Biofilm detachment increased with fluid velocity and the mass of attached biofilm. Biofilm density increased with glucose loading rate. Low density biofilms were filamentous; high density biofilms were nonfilamentous, with dense patches of microbial colonies. Biofilm accumulations increased in proportion to biofilm thickness and with filamentous structure. (Cassar-FRC)
W83-01080

HIGH-DENSITY USE OF SEPTIC SYSTEMS, AVON LAKE, IOWA,
Iowa State Univ., Ames. Dept. of Agricultural Engineering.
K. Mancl, and C. Beer.
Proceedings, Iowa Academy of Science, Vol 89, No 1, p 1-6, 1982. 4 Fig, 3 Tab, 13 Ref. OWRT A-064-IA(2), 14-34-0001-7034.

Descriptors: *Septic tanks, Iowa, *Wastewater treatment, Well water, Nitrate, Longevity, *Iowa, Avon Lake.

Avon Lake, a rural-residential subdivision located southeast of Des Moines, has mostly summer cabins around a remnant gravel quarry. Surface material in the area is sand. Each of the homes has a shallow sand-point well for a water supply and a septic system for sewage treatment. Septic systems were examined for evidence of failure, house to house surveys were performed, and well water samples were taken. Fifty percent of the septic systems have been operating satisfactorily for more than 20 years. Only one of 68 well water samples contained fecal coliform bacteria. Thirty-six samples exceeded the nitrate standard, the highest being 2[illegible] mg/1 N. Nitrate concentration seemed to change in space but not with well age. Nitrogen loadings from cropland, septic systems, and animals were also estimated; they ranged from 40-120 lb/acre (45-135 kg/ha) for cropland, 35 lb/acre (15 kg/ha) for dogs. All three of these could be important sources of nitrogen to the groundwater. W83-01082

DYNAMIC SIMULATOR FOR ANAEROBIC DIGESTION PROCESSES,
Rensselaer Polytechnic Inst., Troy, NY. Dept. of Chemical and Environmental Engineering.
C. Kleinstreuer, and T. Poweigha.
Biotechnology and Bioengineering, Vol 24, No 9, p 1941-1951, September, 1982. 6 Fig, 1 Tab, 24 Ref.

Descriptors: *Anaerobic digestion, *Kinetics, *Organic wastes, *Wastewater treatment, Methane, Model studies, Simulation analysis, Digestion, Biomass, Manure.

An advanced dynamic model simulating the physical and biochemical phenomena of an anaerobic digestion process was developed. The two-culture model focuses on acetogenesis and methanogenesis, assuming that the complex waste has been hydrolyzed in a pretreatment step in a separate reactor. The model calculates the hydrolysis products of several common organic materials, accommodates various substrate feeding modes, and simulates the transient physico-biochemical transport and conversion processes occurring in all phases of a well-mixed reactor. A set of 11 coupled, nonlinear first-order rate equations was derived, based on the principles of mass conservation and biochemical reaction kinetics. Results from computer simulations fell into the range of published data. Biogas production, in particular carbon dioxide, was significantly affected by small changes in overall mass transfer coefficients for carbon dioxide, total N to carbonic species concentrations, and loading and discharge patterns. The process variables (gas flow rates, pH, and rate of volatile acid destruction) are sensitive to changes in substrate concentration, growth and decay parameters of the microorganisms, detention time, and amount of inhibitors present. (Cassar-FRC)
W83-01105

FLUIDIZED-BED FERMENTERS: A STEADY-STATE ANALYSIS,
State Univ. of New York at Buffalo. Dept. of Chemical Engineering.
G. F. Andrews.
Biotechnology and Bioengineering, Vol 24, No 9, p 2013-2030, September, 1982, 4 Fig, 1 Tab, 24 Ref.

Descriptors: *Fermentation, *Fluidized beds, *Films, Nitrogen removal, Nitrates, *Wastewater treatment, Model studies, Particle size, Biomass, Biological treatment, Tower fermenters, Supported-film fermenters, Stratification, Settling velocity, Kinetics.

A mathematical model is developed and used to design fluidized bed fermenters, both tower and supported-film types. This model overcomes some of the limitations of previous models for predicting effluent concentrations from fluidized bed fermenters. Biomass particle size need not be considered as an input parameter but is obtained as a consequence of the process by which the fermenter reaches a steady state. The effects of additional biomass on particle settling velocity are different in the two types of fermenters. In the tower fermenter, adding biomass increases the settling velocity; at steady state the bed is stratified and the cell concentration varies through the bed. In supported-film reactors biomass addition decreases the settling velocity; bed solids are completely mixed because all particles tend to have the same settling velocity in the steady state. Although the supported-film reactor's constant cell concentration is an advantage over the tower reactor's low cell concentration in the upper section, the supported-film process subjects the microorganisms to rapid changes in substrate concentration. Suggestions for better designs are: (1) a tapered tower fermenter which decreases the liquid velocity toward the top, and (2) a supported-film reactor containing variable-sized support particles to allow stratification to predominate over particle mixing. (Cassar-FRC)
W83-01106

ENVIRONMENTAL IMPROVEMENT ON NARRAGANSETT BAY AS A RESULT OF SECTION 312 IMPLEMENTATION OF THE FEDERAL WATER POLLUTION CONTROL ACT,
Rhode Island Univ., Kingston.
For primary bibliographic entry see Field 5G.
W83-01130

MASS TRANSFER IN A ROTATING BIOLOGICAL CONTRACTOR,
Exxon Research and Engineering Co., Florham Park, NJ.
W. K. Shieh.
Water Research, Vol 16, No 6, p 1071-1074, June, 1982. 2 Fig, 1 Tab, 8 Ref.

Descriptors: *Rotating biological contractor, *Mass transfer, *Dentrification, Nitrogen, Nitrates, Oxidation, *Biological wastewater treatment, *Wastewater treatment, Design criteria.

An attempt is made to determine the significance of mass transfer steps on the performance of a zero order rotating biological contractor (RBC). The approach commonly used for heterogeneous catalytic process analysis is used. To assess the mass transfer effects data collected from several RBC denitrification facilities are used. The following conclusions were reached. Substrate transport in the bulk liquid in a RBC is mainly induced by convection, and a constant substrate concentration exists in the bulk liquid. The observed reaction rate in a zero ordered RBC is first order if external mass transfer is rate-limiting. The observed reaction order changes from first order to half order when internal mass transfer becomes predominant. Denitrification RBC systems can be satisfactorily described by a half order kinetics. The effect of external mass transfer is insignificant in a RBC operated at a rotation speed of 7 rpm and a bulk liquid nitrate concentration of 0.9 mg nitrate-nitrogen/liter. The approach as offered in this report provides a rational basis for examining mass transfer effects in a RBC. (Baker-FRC)
W83-01198

ALPHA AND BETA FACTORS FOR DOMESTIC WASTEWATER,
Windsor Univ. (Ontario). Dept. of Civil Engineering.
P. K. Tewari, and J. K. Bewtra.
Journal of the Water Pollution Control Federation, Vol 54, No 9, p 1281-1287, September, 1982. 2 Fig, 7 Tab, 17 Ref.

Descriptors: *Dissolved oxygen, *Oxygen uptake, *Alpha factor, *Beta factor, Aeration, *Wastewater treatment, Domestic wastewater, Laboratory studies.

Laboratory studies were conducted on wastewater and tap water samples to determine factors affecting the alpha factor (the ratio between rates of oxygen uptake in wastewater and tap water) and the beta factor (the ratio between dissolved oxygen saturation concentration in wastewater and tap water). Alpha values were not significantly affected by air flow rate (40-182 ml per min per liter), tank geometry (jar, basin, and rectangular basin), liquid depth (0.3-1.8 m), and aeration device, but they were dependent on wastewater characteristics. Addition of sodium sulfite (2.9-16.0 g) and cobalt chloride (1-4 mg) in various combinations to wastewater samples produced alpha factor values of 0.67-0.925. Beta factor values (average for all samples, 0.97) were not significantly affected by the above parameters. However, the dissolved oxygen saturation concentration increased with increases in water depth. It was more convenient to calculate the beta factor after correcting the dis-

solved oxygen saturation values for dissolved solids in samples. (Cassar-FRC)
W83-01207

CREATION AND OPERATION OF THE METROPOLITAN ST. LOUIS SEWER DISTRICT,
Metropolitan St. Louis Sewer District, MO.
C. B. Kaiser, Jr.
Journal of the Water Pollution Control Federation, Vol 54, No 9, p 1247-1251, September, 1982. 1 Fig.

Descriptors: *Sewer systems, History, St. Louis, *Missouri, *Wastewater treatment.

The Metropolitan St. Louis (Missouri) Sewer District (MSD) was created in 1954 to centralize and coordinate wastewater collection and treatment in the region. Since the first sewers were built about the turn of the century, sewer construction had failed to keep pace with population growth. Many creeks were open sewers contaminated with untreated human and industrial wastes. The MSD, with a work force of 800 persons, is responsible for all wastewater and storm drainage facilities and treatment processes within the region. Within 5 years of the District's formation installation of sanitary sewer trunk lines had removed the disease threat in the streams. Sewer laterals and treatment plants were also built. In 1977 residents of the surrounding St. Louis county voted to be included in the MSD, adding 723 sq km to the 596 sq km area and 70 treatment systems, many of which were inadequate. Stormwater management projects are currently being defined for future implementation. (Cassar-FRC)
W83-01209

COMBINED SEWERS: MAINTAINING YESTERDAY'S INFRASTRUCTURE WITH TODAY'S TECHNOLOGY,
Metropolitan St. Louis Sewer District, MO.
J. F. Koeper, K. L. Coble, and J. Coll.
Journal of the Water Pollution Control Federation, Vol 54, No 9, p 1252-1258, September, 1982. 4 Fig.

Descriptors: *Sewer systems, *Rehabilitation, Combined sewers, Grouting, St. louis, *Missouri, Inspection, Pipes, Linings, Wastewater collection.

A method for predicting potential failures in old, deteriorating combined sewer systems is being developed by the St. Louis (Missouri) Sewer District. The method under consideration assigns a priority ranking, based on risk potential and cost of damages, to a location. Some of the more important information levels would include: statistics on existing sewer routes (age, depth, size, type, etc), soil data, demographic data (to identify areas of high population density and real estate value), history of sewer failures, surface patterns visible from aerial photographs, and water main locations. St. Louis' old sewers have a variety of cross-sectional shapes: horseshoe, egg, and circular. Geological conditions contributing to sewer failures in this region are the alluvial deposits, numerous sinkholes in limestone bedrock, loess deposits, and flooding. Areas designated high risk by the computer analysis would be physically inspected, both visually, if possible, and by instrumental methods. Rehabilitation methods would be chosen according to the type of potential failure: shotcreting for strengthening sewers with large diameters, seal grouting to fill voids in surrounding soil, compaction grouting to compact surrounding soil, slipining for badly cracked or corroded pipes, steel plate lining to strengthen structural integrity, and in-situ forming to avoid extensive excavation. (Cassar-FRC)
W83-01211

SEEPAGE PONDS TO RECYCLE MUNICIPAL WASTEWATER,
South Dakota State Univ., Brookings. Dept. of Civil Engineering.
J. N. Dornbush.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-139691, Price codes: A04 in paper copy, A01 in microfich. Completion Report, South Dakota Water Resources Research Institute, Brookings, July 1982. 49 p, 4 Fig, 6 Tab, 21 Ref, Append, OWRT A-073-SDAK(1), 14-34-0001-0144.

Descriptors: *Stabilization ponds, *Seepage, *Effluent seepage, *Nitrates, Ammonia, Phosphorus, Groundwater, Water pollution, *Groundwater pollution, *Municipal wastewater, *South Dakota, Wastewater treatment, Path of pollutant.

Four stabilization ponds in South Dakota were investigated to determine the long-term impacts of excessive pond seepage on groundwater quality. Emphasis was on nitrogen forms in the groundwater. The ponds had leaked excessively for more than 20 years and similar quality measurements had been made about 1970 for comparison. Seepage quality was measured at groundwater drains (titles and a ditch) and wells installed immediately outside the pond dikes. Chlorides and dissolved solids in the ponds were higher than in the native groundwater and groundwater in the vicinity of the pond may be slightly impaired for irrigation. Nitrate concentrations were acceptable in the groundwater near the ponds but nitrates were unacceptable at some control wells. Ammonia was removed to relatively low concentrations in the pond seepage although the efficiency of ammonia removal was substantially decreased with long-term continual seepage. Phosphorus was consistently removed to levels of 1 mg/1 or less. Limited data revealed that maximum contaminant levels for inorganic chemicals listed in drinking water standards were not being exceeded by the pond seepage.
W83-01238

THE SEPTIC TANK AS A WASTEWATER TREATMENT AND DISPOSAL FACILITY,
Massachusetts Univ., Amherst. Dept. of Plant and Soil Sciences.
P. L. M. Veneman.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-139873, Price codes: A04 in paper copy, A01 in microfiche. Completion Report, Kansas Water Resources Research Institute, Manhattan, September 1982, 22 p, 7 Fig, 4 Tab, 13 Ref. OWRT A-098-KAN(1), 14-34-0001-0118.

Descriptors: *Septic tanks, *Soil absorption capacity, *Leaching, Capillary conductivity, Permeability coefficient, Nonpoint pollution sources, *Wastewater treatment, Septic wastewater, Subsoil drainage, Subsoil, Soil Types, Water Repellent Soils, *Massachusetts, *Public Health Code, Public health standards.

Over 27% of the housing units in Massachusetts rely on the septic tank system for on-site wastewater disposal. The use of soils capable of absorption and renovation of septic tank effluent is essential for the successful disposal of home-generated sewage as the septic tank itself only provides rudimentary treatment. The contributions of the various components of the septic system are discussed on the basis of the available literature. Most soils in Massachusetts are unsuitable for wastewater disposal because of dense, relatively impervious layers in the subsoil, seasonally high groundwater tables, or overall compactness of the soil material. Massachusetts soils are rated for their suitability for on-site sewage disposal in terms of slight, moderate or severe limitations. Management practices to prevent or overcome these limitations are presented. Leaching area requirements are evaluated on the basis of in situ hydraulic conductivity measurements. Results indicate that the sizing criteria in the Massachusetts Health Code are conservative and have sufficient margins of safety to provide adequate treatment and safe disposal of waste waters.
W83-01241

EVALUATION OF DESALINATION TECHNOLOGY FOR WASTEWATER REUSE.
PRC Toups, Orange, CA.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-139899, Price codes: A17 in paper copy, A01 in microfiche. Office of Water Research and Technology Report OWRT/RU-82/8, August 1982. 385 p, 56 Fig, 126 Tab, 176 Ref. OWRT(7802), 14-34-001-7802.

Descriptors: *Wastewater treatment, *Desalination, *Reverse osmosis, *Evaporation, *Water reuse, *Electrodialysis, *Ion exchange, *Freezing, *Ultrafiltration, Wastewater renovation, Industrial wastewater, Municipal wastewater, Agricultural wastewater, Cost analysis.

As environmental constraints on wastewater discharge become more rigorous, desalting techniques are beginning to find application in effluent treatment processes. Applications of desalination technology to the treatment of municipal, industrial and agricultural wastewaters for reuse are beginning to occur. A survey of potential and wxisting applications of wastewaters using current desalination technology was conducted. The processes considered include reverse osmosis, electrodialysis, ion exchange, evaporation, freezing, and ultrafiltration. Standard Treatment Systems for desalination of wastewater have been developed to enable potential users to identify process requirements and costs for specific wastewaters. Industrial, agricultural and municipal wastewater desalination and reuse is technically possible. The relatively high capital, operational and maintenance costs of desalination processes are the primary deterrents to widespread application. However, as wastewater discharge limitations become increasingly restrictive, desalination processes may be economically competitive. Industry is the largest potential user of wastewater desalination and reuse systems. The potential for potable reuse of any wastewater is relatively low due to potentially adverse health effects. Non-potable reuse of municipal wastewaters has average potential in areas with costly or limited water supplies. Industry could use both municipal and agricultural wastewaters in areas with expensive or limited water supplies. The reuse of wastewater for agriculture would greatly increase the costs of food crops. (Moore-SRC)
W83-01270

PRESENCE OF ENTERIC MICROORGANISMS IN THE AIR ENVIRONMENT AT WASTEWATER TREATMENT PLANTS IN PUERTO RICO,
Puerto Rico Univ. Mayaguez. School of Engineering.
M. A. Padovani.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-139915, Price codes: A03 in paper copy, A01 in microfiche. Report, December 1981. 25 p, 3 Tab, 19 Ref. OWRT A-070-PR(2).

Descriptors: *Public health, *Wastewater treatment plants, *Aerosols, *Air pollution, *Coliforms, *Puerto Rico, Enteric bacteria, Trickling filters, Activated sludge process.

In Puerto Rico there is a growing concern about the incidence of diarrhea and other enteric diseases. As an overpopulated island, there is almost no uninhabited region and large amounts of wastewater are generated. As wastewater treatment plants are located near population centers, and as most areas around them are under the action of treatment plant aerosols, a study was undertaken to determine the presence of coliforms of potential health hazard in the vicinity of the plants. The air environment around two trickling filter and two activated sludge wastewater treatment plants was investigated, using impingers of direct exposure of agar plates. The trickling filter plants did not show the production of any aerosolized coliform bacteria that could be detected at a distance of 30.5 m. In the activated sludge plants coliform and fecal coliform bacteria were detected 20.5 m downwind, even though their number was not great. As all samples were taken during daylight hours when solar radiation was at its peak, the temperatures were high, and wind velocity was not high, these test conditions are possibly responsible for the low coliform counts obtained. Both the trickling filter and the activated sludge types of wastewater treatment plants do not seem to be a public health risk as they are effective in reducing the number of coliforms of fecal origin from the aerosols produced by them. (Moore-SRC)
W83-01272

WEAK-ELECTROLYTE ION EXCHANGE IN ADVANCED-TECHNOLOGY WATER-REUSE SYSTEMS,

California Univ., Berkeley. Water Thermal and Chemical Technology Center.
G. Klein, J. Sinkovic, and T. Vermeulen.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-139972, Price codes: A05 in paper copy, A01 in microfiche. Office of Water Research and Technology Report OWRT/RU-82/7, February 1982. 94 p, 35 Fig, 6 Tab, 24 Ref, 3 Append. OWRT C-80300-R(8809)(1), OWRT C-90063-R(9418)(1). 14-34-0001-8809, 14-34-0001-9418.

Descriptors: *Ion exchange, *Resins, *Wastewater treatment, *Phosphates, *Water reuse, Wastewater renovation, Phosphorus removal, Equilibrium, Salinity, Effluents.

Ion-exchange treatment can be used to purify wastewater in various ways, including selective removal of individual unwanted ionic species. Weak-acid and weak-base ion exchangers, relatively new on a commercial scale, furnish and exceptional range of performance capabilities with the prospect of unusually efficient and inexpensive regeneration. Column runs, as well as batch experiments, established the equilibrium data fit the Law of Mass Action, with activity coefficients correcting satisfactorily for nonidealities in both solution and resin phase. Behavior of weak-electrolyte resins is more complex than for strong electrolytes. This produces fairly large nonidealities in dilation behavior and Donnan uptake, and probably also in intraparticle diffusion rates. Phosphate was used as a model impurity in this study, and a secondary municipal effluent high in phosphate was modeled. A combination of general salinity reduction with impurity removal increases the useability of product water. Nearly complete acidification gives the best results for phosphate uptake. A new technique, segmented-bed operation, has been developed to minimize the cost and use of regenerant chemicals, and the disposal of regeneration wastes. By this technique, a major interfering species can be soted on an ion-exchange column, preparing the way for effective removal of the impurity in a separate bed. The sorted species is then returned to the product water by a reversal of the original exchange process. (Moore-SRC)
W83-01275

SORPTION OF PHENOL BY CHEMICALLY TREATED FLYASH,
Sri Venkateswara Univ., Tirupati (India). Coll. of Engineering.
G. Ramprasad, and B. Kotaiah.
Journal of the Institution of Engineers (India), Part EN, Environmental Engineering, Division, Vol 62, No 2, p 56-58, February, 1982. 3 Fig, 2 Tab, 6 Ref.

Descriptors: *Wastewater treatment, *Sorption, *Flyash, *Phenols, Organic compounds, Industrial wastes, India.

A study was made to evaluate the mechanism and sorption capacity of acid treated flyash and to find the effect of weight of flyash sample on the sorption of phenol at constant pH and temperature. The sorption of phenol by chemically treated flyash at pH 4.6 and at a temperature of 28C was found to be sensitive to the weight of flyash in the range of 1-20 g/1. However, there is no significant difference in phenol sorption for 1 and 2 g/1 of flyash. When sorption data is plotted according to the Langmuir equation, a non-linear isotherm is observed at the lkower phenol oncentration for the 20 g/1 of flyash treatment. The sorption maximum value and the constant related to the bonding energy of the sorbate to the sorbent computed for 2 g/1 of flyash are 1.175 mg phenol/g and 0.03415 1/g, respectively. Sorption capacity of flyash per unit weight decreases with increasing initial flyash concentration. The sorption of chemically treated flyash is 16 times more efficient that of the untreated flyash. (Baker-FRC)
W83-01296

SRT TECHNIQUE IN WASTEWATER PROCESS DESIGN,
Polytechnic Inst. of New York, Brooklyn.
R. S. Gupta.
Journal of the Institution of Engineers (India), Part EN, Environmental Engineering Division, Vol 62, No 2, p 68-72, February, 1982. 5 Fig, 1 Tab, 12 Ref.

Descriptors: *Wastewater treatment, *Design criteria, *Biological wastewater treatment, Kinetics, Microorganisms, Biochemical oxygen demand, Oxygen demand, Bacteria, *Solid retention time.

The SRT (solid retention time) technique is based on the kinetics of the microbial growth and the law of conservation of mass. The basic kinetic relations have been developed in a sequence. A simple biological system has been considered to derive the fundamental expression of the SRT relationship. The design parameters, which are manipulations of the kinetic relations and the fundamental equation, have been summarized for three models. The step-by-step procedure for the process design has been described that enables an engineer to design a system. SRT is a function of cell wastage rate and organisms concentration, both being characteristics which are easy to determine. The microbial grown kinetics and mass balance equations with certain assumptions form the basis of simple relations between SRT and various design parameters. The SRT Design Technique, as such, provides a very convenient and simple method of biological treatment process designs. (Baker-FRC)
W83-01297

WATER HYACINTH FOR TREATING DAIRY WASTE,
Delhi Coll. of Engineering (India).
A. F. S. A. Aowal, and J. Singh.
Journal of the Institution of Engineers (India). Part EN, Environmental Engineering Division, Vol 62, No 2, p 73-75, February, 1982. 6 Fig, 2 Tab, 10 Ref.

Descriptors: *Wastewater treatment, *Industrial wastes, *Aquatic plants, Water hyacinth, Biodegradation, Dairy industry, India.

Vascular plants hold considerable promise in the treatment of industrial waste as a cheap method of disposal. The water hyacinth is one such plant. The characteristic changes brought about if water hyacinth is grown in dairy wastes were noted so as to evaluate its potential as a method of treatment for the disposal of organic wastes of similar nature. It was observed that water hyacinth enhanced biodegradation, lowered pH, and in four days BOD was reduced by 60%, COD by 50%, and total solids by 25%. The removal of oil and grease was observed to be 80% in 10 days. These findings were compared with controls without water hyacinth. The results indicate that water hyacinth growth can be used as primary treatment method for reducing BOD, pH, and suspended and total solids for small dairy plant effluents. (Baker-FRC)
W83-01298

TREATMENT OF DAIRY WASTE BY FLOCCULATING ALGAEL BACTERIAL SYSTEM,
Delhi Coll. of Engineering (India).
A. F. S. A. Aowal, and A. K. Agarwal.
Journal of the Institution of Engineers (India), Part EN, Environmental Engineering Division, Vol 62, No 2, p 76-79, February, 1982. 6 Fig, 3 Tab, 10 Ref.

Descriptors: *Wastewater treatment, *Dairy industry, *Flocculation, *Algae, *Bacteria, Biochemical oxygen demand, Chemical demand, Oxidation, Industrial wastes, Aeration, Activated sludge process, Oxidation ponds.

A comparative evaluation of a new technique using the algal-bacterial flocculation system for the treatment of dairy waste is presented. A laboratory study of the algal-bacterial system is compared with the activated sludge system, an oxidation pond system and a simple aeration system. It has been noted, after running all the above processes for 16 days in the laboratory, that while the algal-bacterial system removed about 93% of BOD and 96% COD, the activated sludge system removed only about 90% BOD and 91% COD, the oxidation pond system 51% BOD and 75% COD and the simple aeration system 60% BOD and 64% COD. The performance evaluation of different algal-bacterial ratios showed that 1000 mg/l ofalgal concentration gave the best performance. Four day run of this system seemed to give the best results when compared with the other systems run under the same set of conditions. (Baker-FRC)
W83-01299

REMOVAL OF COLOUR IN TERTIARY TREATMENT OF SANITARY SEWAGE BY CHEMICAL METHODS,
National Environmental Engineering Research Inst., Nagpur (India).
S. R. Kshirsagar, D. S. Joshi, and T. A. Sihorwala.
Journal of the Institution of Engineers (India), Part EN, Environmental Engineering Division, Vol 62, No 2, p 80-83, February, 1982. 3 Fig, 4 Tab, 5 Ref.

Descriptors: Wastewater treatment, *Color removal, *Alum, Chemical reactions, Hazen's units, Textile industry, Dye wastewater, Tertiary wastewater treatment, Wastewater, Industrial wastewater, Lime slurry, Hydrose, Polyelectrolyte.

The results of a study on the removal of color from the secondary treated effluent of an activated sludge treatment plant are presented. For the removal of color different chemicals were used. These include alum, lime slurry, hydrose and liquid polyelectrolyte. From the average characteristic of secondary treated sewage it was clear that for the use of any coagulant, adjustment to alkaline range was relatively easy and economical. Using liquid polyelectrolyte it was noted that the optimum dose of polyelectrolyte for color removal is on the order of 40 0 mg/l which reduced color from 60 to about 5 Hazen's at pH 7.8. Using alum as coagulant took doses between 50 to 70 mg/l with initial color value in the range 40 to 60 Hazen's units. With lime treatment, the increase in dose of lime at pH 11.0 caused improvement in the removal of color rapidly in the beginning but beyond a dose of 250 mg/l the removal was insignificant. This dose reduced the color by 61.9% from its original value of 55 Hazen's units. A dose of 50 mg/l sodium hydrose at pH 7.2 gave color removal to 5.0 from the original 50.0 Hazen's units. The alum treatment worked economically for the desired removal of color. (Baker-FRC)
W83-01300

OPTIMIZED ENERGY EXPLOITATION THROUGH AEROBIC-ANAEROBIC TWO-PHASE STABILIZATION (OPTIMIERTE ENERGIEAUSNUTZUNG DURCH DIE AEROB-ANAEROB ZWEIPHASEN-STABILISATION),
Ingenieur-Buro Unger, Damstadt (Germany, F.R.).
G. Riegler.
Gas- und Wasserfach: Wasser/Abwasser, Vol 123, No 6, p 296-302, 1982. 8 Fig, 16 Ref. English summary.

Descriptors: *Sludge digestion, *Energy, *Wastewater treatment, *Aerobic digestion, *Anaerobic digestion, Biological treatment, Heating, Temperature, Seasonal variation, Methane, Hydrogen ion concentration, Aeration.

The heating of raw sludge to digestion temperature presents the greatest negative factor in the energy balance of anaerobic reactors for sewage sludge stabilization. The suggestion that an air-aerated, self-heating aerobic digestion procedure could effectively be used for this purpose was investigated. A two-and-one-half month long experimental series using two-phase stabilization with an aerobic-thermophilic first stage and an anaerobic-thermophilic second stage (each at 50 C) revealed this system to be effective. Self heating of sludge with aerobic stabilization in isolated tanks can only occur above a certain start temperature that is lower in summer than in winter. If the tank is set up to achieve the greatest possible self heating with the samllest possible substrate degradation, holding times in winter of under three days without external heating sources will not produce stable operating conditions, while in summer holding times of two days will result in self heating. With holding times of 5-10 days, operating temperatures of $>$ 40 C are to be expected all year; above 20 C self heating will always occur. The experiments showed that preliminary aerobic-ther-

mophilic treatment with a short holding time produced degraded sludge that can immediately be stabilized further by anaerobic processes. While the aerobic predigestion reduces possible methane gas development in the next digestion tank, it does contribute to raw-sludge heating (about 20 C with a degradeable COD reduction of about 33% and a 3-day holding time). The aerobic first stage increases pH of raw sludge out of the acid to at least the neutral area, reducing the danger of low pH in the digestion tank. The first stage can reduce volume and concentration fluctuations to improve load distribution in the digestion tank. Further research is necessary to investigate the influences of aerobic predigestion, aerobic-anaerobic environment change, and temperature on metabolic processes in the anaerobic stage and on the stability and quality of the treated sludge. (Gish-FRC)
W83-01304

PRECIPITATION TREATMENT OF MUNICIPAL WASTEWATER WITH ADDED ACTIVATED CARBON (FALLUNGSREINIGUNG VON KOMMUNALEM ABWASSER MIT ZUSATZ VON AKTIVKOHLE),
Hoechst A.G., Huerth/Knapsack (Germany, F. R.).
D. Gleisberg.
Gas- und Wasserfach: Wasser/Abwasser, Vol. 123, No. 6, p 308-313, 1982. 5 Fig, 8 Tab, 10 Ref. English summary.

Descriptors: *Precipitation treatment, *Activated carbon, *Wastewater treatment, *Municipal wastewater, *Combined treatment, Costs, Aluminum, Iron, Phosphorus removal, Phosphates, Zinc, Copper, Heavy metals, Organic compounds, Chemical oxygen demand, Total organic carbon, Dissolved solids, Biological treatment.

A combined procedure of treatment with activated carbon (AC) and precipitating agents was used for municipal wastewater in order to reduce the cost of treatment with AC alone. The results of comparisons between successive and simultaneous treatment of secondary-treatment-basin (STB) water revealed lower total organic carbon (TOC) levels for simultaneous treatment with all precipitating agents. TOC elimination with the combined procedure approached the sum of elimination with the two separate methods, indicating that the treatment media possess different areas of effect and complement each other to advantage. The three agents used, aluminum and iron (Fe(II) and Fe(III)) salts, were similarly useful. The laboratory AC treatment time of 10 min was considered very short, resulting in the reduction of residual COD giving only a shallow curve over time; a rate at least twice as high could be expected in a working wastewater treatment plant. This phenomenon was also reflected in the shallow curve drawn when COD elimination was plotted against AC concentration. Additional precipitation treatment further reduced COD from about 40 to 20 mg/l in STB water and from about 200 to 150 mg/l in primary-treatment-basin water (PTB). Phosphate was successfully removed, indicating good phase separation, as precipitation removes phosphates but AC does not. Both precipitation and AC removed zinc and copper, between one- and two-thirds of zinc being eliminated. With 200 mg/l precipitating agent and 50 mg/l AC, a COD removal rate of 30-50% (maximum 70%) was achieved; similar results were attained for TOC with 100 mg/l AC and 200 mg/l precipitating agents. Both treatments reduced dissolved organic carbon. The physical/chemical treatment of PTB water is only useful for one-stage plants with unsatisfactory treatment results. The results of this investigation should encourage the use of the combined treatment in activated sludge plants. Highly polluted turbulent water resulting from anaerobic sludge digestion may also be so treated. (Gish-FRC)
W83-01307

LOW COST TECHNOLOGY FOR DISPOSAL OF HUMAN EXCRETA WITH COMMUNITY LATRINES,
UP Jal Nigam, Lucknow (India).
G. Sagar.
Journal of the Institution of Engineers (India), Part EN, Environmental Engineering Division, Vol. 62, No. 2, p 47-50, February, 1982. 3 Fig, 2 Tab, 2 Ref.

Descriptors: *Sewer systems, *Design criteria, Soak pits, *India, Wastewater disposal, Latrines.

Attention is focused on design aspects of a new system of latrines in non-sewered areas. By adopting the new design not only is the initial cost reduced, but subsequent maintenance becomes much easier. The first step to improve the community latrine system called for improved design of the septic tank, with tank capacities being worked out for 10 to 100 and 150 to 500 users. Wall thicknesses of 11.4 cm and 23 cm respectively are recommended for the two tank capacities. Structural design considerations indicate that a circular shape is preferred to a rectangular and for reasons of economy. The effluent can be disposed of into soak pits, or it can be discharged into an open drain in areas where drainage systems exist. An improved soak pit design comprises cinder and various sizes of brick ballast or burnt coal, topped with a distribution slab, earth filling and grass layer. The cost of the improved system is significantly reduced. The costs of sanitary fittings are reduced to a minimum, as is the cost of the septic tank. (Baker-FRC)
W83-01319

NITROGEN REMOVAL WITH ROTATING DISC SYSTEM (STICKSTOFFELIMINATION MIT DEM TAUCHTROPFKORPER),
Feng Chia Coll. of Engineering and Business, Taichung (Taiwan).
P-S. Cheung.
Wasserwirtschaft, Vol. 72, No. 6, p 235-239, 1982. 12 Fig, 2 Tab, 5 Ref. English summary.

Descriptors: *Nitrogen removal, *Rotating disc system, *Nitrification, *Denitrification, *Wastewater treatment, Temperature, Sludge age, Biological oxygen demand, Sludge excess, Methanol, Industral wastewater, Municipal wastewater, Water treatment.

A rotating disc system (RDS) was used to investigate the efficacy of nitrification and denitrification for nitrogen removal in the treatment of drinking water. With a 5-day BOD disc load of < 5 g/sq m per day, an NH4(+)-N reduction of $> 90\%$ was achieved, while with higher disc loads the reduction quickly diminished. Successful nitrification and 5-day BOD reducxtion will occur with a two-cascade RDS under disc loads of 4.5 g/sq m per day for 5-day BOD and 2.5 g/sq m per day for NH4(+)-N. However, a four-cascade RDS is recommended, and this can tolerate higher loads. The influence of flow-through time is negligible compared with that of 5-day BOD disc load, and within the range of 5-22 C temperature influence is also insifnificant. Acid capacity was reduced by nitrification, but not to the extent that it hampered the process, With low 5-day BOD disc load (< 5 g/sq m per day), sludge age was high (> 5 days), and thus nitrification was successful. An excess slude production of 0.4 kg/kg 5-day BOD degradation occurred with nitrification. Nitrogen removal can be achieved through the addition of methanol in the denitrification stage for industrial wastewaters containing nitrate in the absence of other carbon compounds. For municipal wastewaters,. a RDS with low loads and preliminary denitrification stage is recommended for nitrogen elimination. Over 60% nitrogen removal with 200% feedback of raw wastewater as an electron donor is technically feasible. (Gish-FRC)
W83-01323

NITROGEN REMOVAL BY MEANS OF PRELIMINARY DENITRIFICATION (STICKSTOFFELIMINATION DURCH VORGESCHALTETE DENITRIFIKATION),
Stuttgart Univ. (Germany, F.R.). Inst. fuer Siedlungwasserbau, Wassergute- und Abfallwirtschaft.
K. Krauth, and K. F. Staab.
Wasserwirtschaft, Vol 72, No 6, p 251-252, 1982. 1 Fig, 5 Tab, 1 Ref. (No English Summary).

Descriptors: *Nitrogen removal, *Denitrification, *Activated sludge process, Municipal wastewater, *Wastewater treatment, Federal Republic of Germany, Biological wastewater treatment, Oxygen, Ammonium, Organic compounds, Weather.

An activated sludge wastewater treatment plant with aerobic stabilization in Biet (Federal Republic of Germany) was used to test the efficiency of nitrogen removal by means of preliminary denitrification. The activated sludge basin used was intended for 7,000 population equivalents with a dry-weather inflow of 104.5 cu m/hr (24-hr mean, 92.0 cu m/hr). The secondary clarification basin had a capacity of 185.0 cu m/hr of rainwater and was provided with this amount during the experiment. The experiment showed that the oxidation of ammonium nitrogen to nitrites and nitrates was dependent on the oxygen concentration in the nitrification basin. The minimal daily oxygen concentration was the deciding value as long as it did not last more than one hour. In the latter case, some concentration of NH4(+)-N was to be expected in the effluent. NH4(+)-N effluent concentrations approaching zero can only be expected with a minimum oxygen concentration in the nitrification basin of 0.5 mg/l. Organic nitrogen concentrations of 1.34-7.70 mg/l were found in the plant effluent despite the fact that ammonium content was near zero. When the denitrified nitrogen values were related to the solids content in the denitrification stage, the resulting total denitrification rate ranged from 0.0129 to 0.0576 kg/(kg x day), with noticeable differences occurring between wet and dry weather. The success quotient H, resulting from the relationship between the actually denitrified nitrogen volume and the theoretically denitrifiable nitrogen volume (taking recirculation into account), ranged from 61.7% to 89.9% (total and was lower in wet (53.8-75.8%) than in dry (79.2-96.9%) weather. (Gish-FRC)
W83-01324

CAUSES, PREVENTION AND CONTROL OF BULKING SLUDGE IN ACTIVATED SLUDGE PLANTS (URSACHEN, VERHINDERUNG UND BEKAMPFUNG DER BLAHSCHLAMMBILDUNG IN BELEBUNGSANLAGEN),
Wehrle-Werke A.G., Emmendingen (Germany, F.R.).
F. Wagner.
Wasserwirtschaft, Vol 72, No 6, p 229-234, 1982. 8 Fig, 1 Tab, 11 Ref. English summary.

Descriptors: *Bulking sludge, *Activated sludge, *Wastewater treatment, *Filamentous microorganisms, *Phosphorus, Nitrogen, Denitrification, Biological oxygen demand, Heat loss, Calcium, Iron compounds, Sludge index.

In more than half of all activated sludge plants the desired degree of purification is not attained, due in many cases to inadequate separation of the activated sludge from the treated water. This is often associated with the development of filamentous microorganisms, which promote the formation of bulking sludge. Bulking sludge is defined as activated sludge with a sludge index (SI) of > 150 mg/g. The results of chemical and physical analysis of 150 activated-sludge samples from 150 treatment plants revealed that in municipal plants the filamentous bacteria Type 021 N, Microthrix parvicella and Type 0041 together form about 50% of bulking sludges. Plants with preliminary treatment produced sludges with the highest SI: in about 70% of these plants an SI of 150 ml/g was exceeded in two months of the year. The SI was positively related to the 5-day BOD volume load, with a maximum SI occurring with loads of 0.4-0.7 kg/(cu m per day) in these plants. Sludges with a heat loss of $> 70\%$ were not easily separated. SI and phosphorus/nitrogen ratio were positively related. Two hypotheses for the cause of bulking sludge formation are discussed. The surface-volume hypothesis postulates that filamentous organisms, because of their large surface area, have a selective advantage over floc-forming bacteria when a large amount of dissolved substrate exists in wastewater. The phosphorus/nitrogen hypothesis suggests that low phosphorus levels are responsible for bulking sludge formation. This hypothesis was confirmed in an experiment using the phosphorus/heat loss ratio in place of the phosphorus/nitrogen ratio. Denitrification can therefore aid in the prevention

of bulking sludge formation. Methods to control the problem include the addition of iron salts into activated-sludge circulation, the use of calcium in the inflow to the secondary treatment basin, and the substitution of Thomas phosphate for phoshoric acid in wastewaters low in phosphates. (Gish-FRC)
W83-01325

EXPERIENCE REPORT FOR DECENTRALIZED WASTEWATER TREATMENT (ERFAHRUNGSBERICHT MIT DER DEZENTRALEN ABWASSERREINIGUNG),
Peter Scholz Ing. G.m.b.H., Kirchberg/Jagst (Germany, F.R.).
R. Pfeiffer.
Wasserwirtschaft, Vol 72, No 6, p 250-251, 1982. 1 Fig. (No English Summary).

Descriptors: *Wastewater facilities, *Costs, *Biological oxygen demand, *Municipal wastewater, Hoval Compact Wastewater Treatment Facility, Biological wastewater treatment, Phosphorus removal, Rotating disc system, Precipitation treatment, Federal Republic of Germany.

The Hoval Compact Wastewater Treatment Facility has been in use in the Federal Republic of Germany since 1976. It is designed to provide advanced wastewater treatment including phosphate removal for population equivalents of 100-3,000. The three-stage process consists of primary mechanical treatment, biological treatment, and chemical precipitation with secondary treatment. It has been proven that the rotating disc system in combination with other processes works well for small communities. The special advantage of this system is its favorable relationship between energy requirement and purification level as well as its insensitivity to load fluctuations. A significant increase in efficiency of the mechanical stage is achieved by recirculation into the sedimentation basin after the biological stage. In the third stage the precipitating agent is added to the multi-chamber flocculation tank proportional to the volume of water to be treated to reduce costs. To investigate the efficacy of this process, measurements of 5-day BOD, COD and methylene blue active substances were made at 14 plants over 286 days. The legal limit of 25 mg/l 5-day BOD in inflow was not exceeded. Plant stability was extremely high and corresponded to that of fully biological plants with low loads. Five-day BOD levels of 20 mg/l could be maintained even with excessive loads, and in general a total phosphate level of < 1 mg/l could be achieved. Hydraulic peaks in the biological stage are avoided by using intermediate buffers in the primary stage; this also allows an absence of hydraulic overload in the third stage. (Gish-FRC)
W83-01326

FIRST OPERATIONAL EXPERIENCE AT THE WASTEWATER TREATMENT FACILITY OF THE BREISGAUER BUCHT WASTEWATER ASSOCIATION (ERSTE BETRIEBSERFAHRUNGEN AUF DER KLARANLAGE DES ABWASSERZWECKVERBANDES BREISGAUER BUCHT),
G. Heinz.
Wasserwirtschaft, Vol 72, No 6, p 253-255, 1982. 3 Fig, 2 Tab. (No English Summary).

Descriptors: *Wastewater facilities, *Biological oxygen demand, *Nitrification, *Activated sludge process, Carbon dioxide, Hydrogen ion concentration, *Federal Republic of Germany, Breisgauer Bucht wastewater treatment facility, *Wastewater treatment, Biological treatment, Costs.

The first report of operation of the Breisgauer Bucht (Federal Republic of Germany) mechanical-biological wastewater treatment facility is presented. The facility was built to serve an area of about 500 sq km with 600,000 population equivalents (PE). In 1980 about 27 h cu m and in 1981 about 45 h cu m of water were treated, and in 1981 the dry weather inflow was about 100,000 cu m/day. The plan for available storage space in the inflow and bypass channels to be used in rainy weather was successful, as evidenced by the fact that in only three cases did combined water overflow into the receiving stream. Minor problems encountered during the pilot run and early operation were easily corrected. Daily 5-day BOD levels were 7.5-46.5 and 3.2-36.3 metric tons in the inflows to the plant and biological stage, respectively; levels in effluent ranged from < 3 to 86 (mean, 17). Undissolved substances and settleable substance were found in the effluent in concentrations of < 10 and < 0.1 mg/l, respectively. Aeration times ranged from 2.5 to 5.7 hours. The operation of the activated sludge plant with oxygen gasification was very stable. The various processes hardly affected effluent 5-day BOD or COD, though they did produce fluctuations in the differences between 5-day BOD as determined by the presence or absence of nitrification inhibitors. Little nitrification occurred with two activated sludge basins and a dry matter loading < 0.2. With three basins and a dry matter loading = 0.16, the nitrification rate was about 35%. The highest rate was > 80% in October and November at a dry matter loading of 0.12. With sludge loads of = or > 0.16 the carbon dioxide level was < 18 mg/l, but with dry matter loading = 0.12, the average level was 38 mg/l. With sludge-load reduction, pH value also declined. (Gish-FRC)
W83-01327

COSTS OF PREVENTIVE MAINTENANCE PROGRAMS IN WASTEWATER COLLECTION SYSTEMS,
Burns and Roe Industrial Services Corp., Paramus, NJ.
J. Liebesking, and J. LaFond.
Public Works, Vol 113, No 9, p 82-84, September, 1982. 1 Fig, 5 Tab, 5 Ref.

Descriptors: *Costs, *Wastewater collection, *Maintenance costs, Capital costs, Estimated costs, Operating costs, Total costs, Wages, Personnel, Sewer systems.

Estimates of average annual costs for providing preventive and corrective maintenance programs are given for wastewater collection systems serving population sizes of 10,000 to 1 million. Total costs (in 1980 dollars), not including major reconstruction or new construction, are $167,000-$12,033,000. Personnel costs, $62,000-$4,850,000, are listed according to occupational title, annual salary, and number of each type of employee. Operating costs are assumed equal to personnel costs. Equipment needs are $20,000-$586,000. Administrative costs, $23,000-$1,765,000, are assumed at 18% of operating and maintenance costs. A formula is given to adjust for differences in local costs and inflation. (Cassar-FRC)
W83-01339

FRITO-LAY TURNS WASTE INTO PROFIT.
Food Engineering, Vol 54, No 9, p 102-104, 106, September, 1982. 1 Fig, 1 Tab.

Descriptors: *Wastewater treatment, *Food processing industry, *Design criteria, Industrial wastes, Advanced wastewater treatment, Wastewater facilities, Treatment plants, Frito-Lay, Frankfort, *Indiana, Industrial plants.

Frito-Lay Corporation included in its planning of a huge snack food plant in Frankfort, Indiana, its own waste treatment system rather than pay for inclusion in the municipal system already there. As a result the company expects to generate $60,000 to $80,000 per year in sales of wastewater byproducts. The system also avoids sludge removal costs in excess of $100,000 per year. A unique heat recovery system and energy related improvements in the process line allow the plant to save an estimated 400,000 gallons per year in fuel oil and $300,000 per year in energy costs. Through energy efficient pollution control measures an additional $126,000 per year is estimated to be saved. The on-site wastewater treatment consists of primary and secondary treatment of process wastewater, plus on-site tertiary treatment prior to discharge into Wildcat Creek. Process wastewater comes from potato wastewater from washing; and oil and grease wastewater from cleaning of processing equipment. (Baker-FRC)
W83-01351

PROCESS DESIGN OF ANAEROBIC SLUDGE DIGESTION,
Severn-Trent Water Authority, Birmingham (England).
G. P. Noone.
Effluent and Water Treatment Journal, Vol 22, No 5, p 193-194, 196-197, May, 1982. 5 Fig, 1 Tab, 20 Ref.

Descriptors: *Sludge digestion, *Design criteria, Anaerobic conditions, Sludge, *Wastewater treatment.

Relevant areas for considertion in the process design of anaerobic Sludge digestion programs are considered. Absolute design values are not available in many important areas, although work to remedy this is underway in many cases. Any meaningful use of the detention time parameter requires a fully utilized reactor volume, since any ineffective reactor volume reduces the nominal detention time. Solids level is the other important processing input determining reactor volume. Extreme loadings have been cited as causing process failure at very low detention periods. The majority of inherited digestion systems seem to have been provided on some variation of the completely mixed system. For new plants, other reactor systems, notable a plug flow or multi-step simulated plug flow system, would offer theoretical advantages of smaller overall reactor volume as well as an improved quality of product, resulting from minimizing short circuiting, and may appear as a reduced level of pathogen in the exit sludge. The mixing requirements of the digester must be considerted in the planning stages. The other major processing input responsible for governing reactor size is the increased rate of reaction at higher temperatures, enabling smaller reactors to be used. To avoid a thermal shock situation within the reactor, raw sludge feeding rates must also be considered. Sludge feeding systems should also be considered, as should digester control systems, construction materials for use in provision of reactor volume and gas production, energy studies including gas usage, insulation and heat recovery techniques. (Baker-FRC)
W83-01353

EVALUATION OF THE USE OF IODINE FOR DISINFECTION OF EFFLUENT FROM ON-SITE 'PACKAGE' WASTEWATER TREATMENT SYSTEMS,
Pennyslvania State Univ., University Park. Dept. of Civil Engineering.
T. J. Whitehill.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-146662, Price codes: A03 in paper copy, A01 in microfiche. Masters' Thesis, May 1982. 33 p, 5 Fig, 4 Tab, 10 Ref. OWRT-B-122-PA(2). 14-34-0001-0245.

Descriptors: *Disinfection, *Iodine, *Wastewater treatment, *Effluent, *On-site treatment, Domestic wastes, Cost analysis, Chlorination, Sand filters, Organic matter.

Iodine was shown to be a feasible alternative as an agent for the disinfection of wastewater effluent from small 'package' wastewater treatment systems. The primary advantage associated with the use of an iodine crystal column iodinator rather than an erodible chlorine tablet system for wastewater effluent disinfection is the longer intervals between disinfection agent replacement for the iodine unit. The estimated additional cost to the user is $6.33 per month for the disinfection of effluent from a single-family wastewater treatment unit. Contact tank design and the degree of treatment prior to disinfection can affect greatly the performance of the crystal column iodinator as well as the rate of iodine consumption. Plug flow contact tanks should be used whenever possible and should be designed to provide the recommended 20 to 25 minutes contact time. If the wastewater is to be used for the dissolution of the iodine crystals, it should first be passed through a sand filter. If a sand filter is not used, then the possibility of organic fouling of the iodine crystals exists and a separate clear water line may have to be used for dissolution of the iodine crystals. The recommended ratio of wastewater effluent flow to clear water

flow is approximately 30:1 in order to provide for sufficient dissolution of iodine. The iodine crystal iodinator operated 2 months without refilling, compared with 3 to 4 weeks for erodible chlorine tablet systems. (Moore-SRC)
W83-01361

AN INVESTIGATION INTO THE REMOVAL OF ALGAE BY FINE SAND/SILT FILTRATION,
Louisiana Water Resources Research Inst., Baton Rouge.
B. Naghavi, and R. F. Malone.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-146720, Price codes: A08 in paper copy, A01 in microfiche. Report, November 1981. 153 p, 9 Fig, 5 Tab, 48 Ref, 2 Append. OWRT A-052-LA(1).

Descriptors: *Algae, *Sand filters, *Wastewater treatment, *Water treatment, *Filtration, *Scenedesmus, Silt, Head loss, Particle size, Cholorphyll A.

One of the problems in water and wastewater treatment is the lack of an economical technology to remove algae from eutrophic surface waters and stabilization ponds. A laboratory scale study was undertaken to determine the feasibility of a method of filtering algae from water using fine sand/silt as a filter media. Five median sand sizes (0.064 to 0.335 mm) and four bed depths (3.2 to 12.7 mm) were examined in constant head experiments with the algae Scenedesmus quadricauda. A total of 46 experiments were conducted with continuous measurements of flow rate, head loss and effluent quality. All media with median sand sizes at or below 0.200 mm gave consistently high algae removal rates. Sand with median grain size diameter of 0.200 mm with a bed depth of 3.175 mm produced an effluent quality with average removal of 96% (based on chlorophyll a). This combination of grain size and bed depth also resulted in highest initial flow rate (246 cu m/sq m/d) and lowest initial head loss (7.75 cm). Run times were short due to surface clogging of the media. No chemical addition was required to obtain high removal levels. The principal filtration mechanism with the fine sand/silt filter appears to be direct straining on the surface of the filter media. (Moore-SRC)
W83-01367

DESIGN CONSIDERATIONS FOR USE OF ON-SITE SAND FILTERS FOR WASTEWATER TREATMENT,
Pennsylvania State Univ., University Park. Research on Land and Water Resources.
R. L. Dymond.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-146738, Price codes: A10 in paper copy, A01 in microfiche. Masters' Thesis, May 1981. 206 p, 15 Fig, 23 Tab, 60 Ref, 2 Append. OWRT B-122-PA-(1). 14-34-0001-0245.

Descriptors: *Sand filters, *Wastewater treatment, *On-site treatment, *Pennsylvania, Sanitary wastewater, Domestic wastes, Disinfection, Legislation, Ultraviolet radiation, Chlorination, Filters, Septic tanks, Effluents.

Soil characteristics in much of Pennsylvania are such that a typical on-site septic tank/soil absorption system will not function properly. Also, use of such typical systems is limited in many areas by the depth to the ground water table. It is felt that an enclosed sand filter system with surface discharge would be the most successful method of providing on-site wastewater treatment where unsuitable conditions are encountered. Three major sand filter system alternatives were investigated: the recirculating sand filter, the buried sand filter, and the intermittent sand filter. The buried sand filter is the most outdated and least efficient. The recirculating sand filter system is subject to freezing, and it is a complicated system. The most economically and technologically feasible system is the intermittent type sand filter. This filter usually follows a pretreatment unit such as a septic tank, and has the capability of providing for the release of the effluent into the ground or to surface waters. Disinfection is usually produced by chlorination (tablet erosion) or ultraviolet irradiation. The major problem with on-site sand filter systems is the required maintenance, without which the system is sure to fail. The necessary maintenance requirements are determined by the sand size. To aid in establishing the present legislative viewpoint on various on-site surface discharge systems including sand filters, a survey was conducted of all state legislation and recommendations. (Moore-SRC)
W83-01368

5E. Ultimate Disposal Of Wastes

LEACHING OF CADMIUM FROM PIGMENTED PLASTICS IN A LANDFILL SITE,
Harwell Lab., Oxon (England).
For primary bibliographic entry see Field 5B.
W83-01068

PROTECTING PUBLIC GROUNDWATER SUPPLIES,
For primary bibliographic entry see Field 5G.
W83-01071

SEDIMENTAL JOURNEY,
Texas Agricultural Extension Service, College Station.
J. M. Sweeten.
Feedlot Management, Vol. 23, No. 4, p 26, 28, 32, April, 1981. 1 Tab.

Descriptors: *Feedlot runoff, *Feedlot wastes, *Waste management, Animal wastes, Farm wastes, Barn wastewater, Agricultural runoff, Manure, Drying, Sedimentation, Dredging, Land disposal, Sludge, *Texas.

Sediment in feedlot runoff holding ponds is difficult and expensive to remove, haul and spread. Containing up to 10-20% solids, it is too thick for pumping and too fluid for efficient dredging operations. Sediment removal operations were studied at a 25,000 head feedlot in Southwest Texas. The dirt-surfaced feedlot occupies 93 acres including feed pens, alleys, mill area and cattle handling facilities. All runoff is channeled into three holding ponds with a combined capacity of 44 acre-feet. Runoff from 13 inches of rainfall in a 30 day period plus 12 years acculation of sediment left the holding ponds full despite regular liquid withdrawals for irrigation of 300 acres of alfalfa. Electric centrifugal irrigation pumps were used to restore system capacity. Subsequently, following a short drying period, sediment was excavated using a dragline. Analytical results showed that total salts would be the limiting factor in land disposal of this effluent. Because of the fluid consistency of the sediment, a full dragline bucket contained only 0.85 cubic yard of sediment. Four to six weeks later, sediment was removed from the drying trenches, loaded into a conventional feedlot manure spreader truck, and applied to alfalfa and fallow sorghum fields. The sediment still contained more than 65% moisture, which hampered the loading and spreading operation. (Baker-FRC)
W83-01140

SLUDGE MARKETING: THE QUIET REVOLUTION,
K. C. Flynn.
Journal of the Water Pollution Control Federation, Vol 54, No 9, p 1267-1269, September, 1982.

Descriptors: *Sludge disposal, *Soil amendments, *Land application, Milorganite, Composting, Land disposal, Land reclamation, Heavy metals, Cadmium, Pretreatment of water.

Above 50% of the nation's sewage sludge is now applied to the land. This shift toward land disposal was influenced by a turn away from ocean dumping and by the development of a simple composting technique. Wastewater pretreatment has reduced the levels of heavy metals, especially cadmium, in the sludge. Among the communities marketing or giving away sludge are Milwaukee, Wisconsin (60,000 tons per year of Milorganite); Philadelphia (liquid Philorganic and dried Gardenlife); Los Angeles; Washington, D. C. (product used in many nearby National Parks); Salem, Oregon (Biogro, a liquid), and Madison, Wisconsin (Metrogro, liquid sludge injected into farmland). Although sludge marketing programs are usually operated at a loss, they are nevertheless a low cost and environmentally acceptable disposal alternative. Users of sludge include commercial growers, landscapers, contractors, farmers, and home gardeners. Composted sludge finds use in three markets: intensive plant culture, restoration of lands disturbed by mining or construction, and as a soil conditioner for crop lands. Regulations on sludge application have not been issued on the federal or state level. (Cassar-FRC)
W83-01208

MICROBIAL CONTAMINATION OF CONTINENTAL SHELF SEDIMENTS BY WASTEWATER SLUDGE,
Environmental Protection Agency, Annapolis, MD.
For primary bibliographic entry see Field 5B.
W83-01214

WHERE WE ARE BUT WHERE ARE WE GOING,
D. V. Feliciano.
Journal of the Water Pollution Control Federation, Vol 54, No 9, p 1259-1266, September, 1982. 4 Tab.

Descriptors: *Sludge disposal, *Land disposal, *Wastewater management, Financial aspects, Heavy metals, Pathogens, Organic compounds, Water pollution sources, Public opinion.

Management of municipal sludge remains a difficult problem. Land application is considered, with emphasis on proper management, reclamation of resources, risk considerations, and a review of the realities of sludge. Sludge management in the US is accomplished through five basic options: land application, landfilling, incineration, ocean disposal, and others such as lagooning. The advantages of land application are that sludge, stabilized either through digestion or composting to a form that can be used again, is applied to the land in either an agricultural setting as a fertilizer or soil conditioner or in a reclamation project to recover an area that was previously of little value. Problems include a shortage of available land, transportation costs, and need for interstate transport. Of significant concern is the quantity of undesirable substances in the sludge, including pathogens, organic chemicals and heavy metals. Before land application can be broadly accepted by the public, an extensive education program is needed to explain potential hazards and quiet the fears. (Baker-FRC)
W83-01215

PATHOGENIC AMOEBAE IN OCEAN SEDIMENTS NEAR WASTEWATER SLUDGE DISPOSAL SITES,
National Marine Fisheries Service, Oxford, MD.
For primary bibliographic entry see Field 5C.
W83-01216

EFFLUENT--A QUESTION OF SLUDGE,
T. D. Salter.
Water Services, Vol 86, No 1037, p 329-330, July, 1982. 2 Fig.

Descriptors: *Dewatering, *Sludge filters, *Filters, *Sludge disposal, Compaction, Vacuum filters, Sludge thickening, Sludge volume index.

Sludge compaction on site may reduce costs for plants with a sludge production greater than 9000 liters per week. A content desirable for shoveling and stacking is about 10-25%. A graph shows the sludge volume of a 2% sludge at various residual solid levels. Sludge volume decreases rapidly from 2% sludge solids (10,000 units of volume) to 10% (2500 units), slowly from 10% to 25% (1000 units), and very slowly from 25% to 50% (500 units). Two common filters are used for sludge compaction; filter presses and vacuum filters (rotary drum, rotary belt, or horizontal belt). Choosing a suitable

system depends on the nature of the sludge and other factors. (Cassar-FRC)
W83-01334

PRIMARY SLUDGE MASS FLOW MEASUREMENT,
M. R. Bowers.
Water Services, Vol 86, No 1037, p 333, July, 1982. 2 Fig.

Descriptors: *Sludge solids, *Flow measurement, Automation, Equipment, Measuring instruments, Wastewater treatment, Sludge disposal, *England.

A primary sludge mass flow measuring system was installed at the Haven Road Works, Anglian Water Authority. A magnetic flowmeter and a density meter determine the volume and density of sludge, respectively, from which the dry solids weight may be calculated automatically. Measurements are done during pumping of sludge into the tank trucks which transport sludge. The measurement system saves operating costs by making it possible to transport sludge when it is near the optimum density, 6%. Previously, tankers removed sludge on a scheduled basis regardless of sludge density, which sometimes was as low as 1%. Use of the new system has resulted in fewer truck trips and a better, more uniform sludge density. Equipment for an on-line automatic desludging system has been installed in a pilot project. This removes sludge whenever it reaches a predetermined density. (Cassar-FRC)
W83-01336

FRITO-LAY TURNS WASTE INTO PROFIT.
For primary bibliographic entry see Field 5D.
W83-01351

5F. Water Treatment and Quality Alteration

PROGRESS TOWARD A SOLUTION TO THE NITRATE PROBLEM,
Minnesota Univ., Minneapolis. Dept. of Chemistry.
M. M. Kreevoy, and C. I. Nitsche.
Environmental Science and Technology, Vol 16, No 9, p 635-637, 1982. 2 Fig, 21 Ref.

Descriptors: *Water treatment, *Solvent extraction, *Nitrates, Membrane processes, Nitrogen removal, Industrial wastes, Benzene, Trioctyl phosphate, Phosphates, Water pollution sources.

Excessive nitrate ion in drinking water is a widespread problem resulting from agricultural and industrial activity, domestic sewage and auto exhausts. Solvent extraction may prove helpful in controlling this situation. The equilibrium constant for the extraction of nitric acid from water by a fatty amine in a water-immiscible liquid is increased by a factor of 100 when the solvent is changed from benzene to trioctyl phosphate. This permits the hydrogen and nitrate ions to be coextracted from a near-neutral solution. The amine solution in trioctyl phosphate can be carried on a thin porous plastic support and used as a membrane. Such a membrane has been mounted in a modified dialysis cell, with loading carried out on one side and stripping with base on the other. This device is efective in removing nitrate from water. (Baker-FRC)
W83-01072

DYNAMICS OF BIOFILM PROCESSES,
Nalco Chemical Co., Naperville, IL.
For primary bibliographic entry see Field 5D.
W83-01080

WATER QUALITY ASSURANCE BY PHOSPHORUS REDUCTION IN DRINKING WATER RESERVOIRS (SICHERUNG DER TRINKWASSERGUTE ALS FOLGE VON PHOSPHORELIMINIERUNGSMASSNAHMEN AND TRINKWASSERTALSPERREN),
Wahnbachtalsperrenverband, Siegburg (Germany, F.R.), English Summary.
H. Bernhardt.
Zeitschrift fur Wasser and Abwasser Forschung, Vol 15, No 3, p 157-164, June 1982. 8 Fig, 2 Tab, 35 Ref.

Descriptors: *Drinking water, *Phosphorus removal, *Reservoirs, *Algal growth, *Eutrophication, *Federal Republic of Germany, Wahnbach reservoir, Filtration, Flocculation, Water treatment, Disinfection, Chlorination, Organic compounds, Trihalomethanes, Taste, Odor.

The effects of periodic mass growth of algae on the quality of drinking water from eutrophic reservoirs are described using the Wahnbach reservoir (Federal Republic of Germany) as an example. Dissolved organic compounds formed in stored water and particulate organic substances are mainly responsible for algal bloom. Problems in water treatment caused by these conditions are not fully measurable and cannot always be controlled with certainty using existing treatment methods. Particularly in small reservoirs, the extraction of water from the hypolimnion can result in almost the entire reservoir changing to epilimnion and thus to an algal production zone. Massive development of siliceous algar (2,700 cells/ml) at Wahnbach in 1972-3 shortened filter lifetime to 8 hours. Zooplankton such as Keratella cochlearis can free themselves from oxidehydroxide flocs and break through the filter to drinking water. Some organic compounds formed from algae consume chlorine, resulting in a need for additional chlorine input for disinfection purposes. These compounds also possess precursor properties and during chlorination form trihalomethane compounds which may appear in drinking water. Inadequate disinfection allows possible reproduction of algae in the water supply; at Wahnbach this danger increased when the dissolved organic matter content in treated drinking water exceeded 1 mg/1. This occurred during a mass bloom of Oscillatoria rubescens at the end of the 1960s and increased during the blue and green algal bloom of the 1970s. Since the introduction of a phosphorus-removal plant at the reservoir, the dominat blue algae have disappeared and green-algal development is slight. Water-treatment procedures have been significantly simplified in the now-mesotrophic reservoir. (Gish-FRC)
W83-01114

REMOVAL OF HUMIC SUBSTANCES AND TURBIDITY IN WATER SUPPLY SOURCES BY POLYMER COAGULATION AND DIRECT FILTRATION,
Massachusetts Univ., Amherst Water Resources Research Center.
F. A. DiGiano, E. J. LaMotta, K. B. Black, and M. C. Zapata-Moreno.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-139857, Price codes: A04 in paper copy, A01 in microfiche. OWRT A-116-MASS(1), 14-34-0001-9023. Publication No. 124, July, 1981. 46 p, 2 Tab, 17 Fig, 26 Ref, Append.

Descriptors: *Turbidity, *Color, Drinking water, Treated water, *Water treatment, *Chlorination, *Coagulation, *Filtration, Clarification, *Chemical treatment, *Cost analysis, *Polymers, Water supply, Water quality, Water quality standards, Treated water, *Trihalomethane formation, *Massachusetts, Drinking water standards, New England.

Many protected surface water supplies in New England receive no treatment other than chlorination and corrosion control. These waters are generally low in both alkalinity and turbidity and low to moderate in natural color. More stringent limits on turbidity and trihalomethanes (which are produced when waters containing natural color are chlorinated) may force many communities to construct expensive conventional filtration plants. This research attempted to investigate use of a cationic polymer as the primary coagulant with the dual objectives of removing turbidity and organic precursors to trihalomethane production. Such a procedure might be an alternative to direct filtration. A leaf and soil extract provided the source of turbidity and trihalomethane formation potential (THMFP) in laboratory filtration of a low alkalinity water supply. The cationic polymer, Betz 1190, in a dosage of about 7 mg/1 gave a good performance over a fairly wide range of influent turbidity (6 to 15 NTU) and (THMFP) (315 to 562 ug/1). Filter run times varied from 6.5 to 12.5 hours before turbidity exceeded 1 NTU; color removal varied from 66 to 83 percent and THMFP from 45 to 55 percent. The results are especially promising given that a rather high application rate of 6 gpm/ft2 was used.
W83-01239

THE INFLUENCE OF ALGAL GROWTH AND OTHER ECOLOGICAL FACTORS IN RESERVOIRS ON THE PRODUCTION AND CONTROL OF TRIHALOMETHANE PRECURSORS,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Civil Engineering.
R. C. Hoehn, C. W. Randali, J. K. Malone, and K. L. Dixon.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-140012, Price codes: A07 in paper copy, A01 in microfiche. Completion Report, January, 1982. 143 p, 41 Fig, 6 Tab, 59 Ref, Append. OWRT-A-087-VA(1).

Descriptors: Drinking water, Water treatment, Algae, Reservoirs, Trihalomethane precursors, Lake water organics, *Trihalomethanes, *Algal growth, *Dissolved organic carbon, Chloroform, Alum coagulation, *Virginia, Claytor Lake, Water pollution treatment.

The objective of the research was to assess the importance of biological activity in a reservoir in altering the nature of the dissolved organic carbon (DOC) content, especially that portion of the DOC that serves as precursors for trihalomethanes (THMs), such as chloroform, that form when water is disinfected with chlorine during drinking-water treatment processes. The study also sought to evaluate the effectiveness of alum coagulation for removing THM precursors. Lake water was fractionated into its hydrophilic and hydrophobic solubility classes; these fractions were analyzed for the DOC content and THM-formation potential. Algal productivity and extra-cellular product during a six-hour period was determined, and the incubated lake-water samples were also fractionated. Diurnal studies were made to relate primary productivity and extracellular product to daily variations in the lake's DOC concentrations and THM-formation potential. Results showed that the majority of lake water DOC and THM-precursors were hydrophobic in nature. The diurnal studies provided strong evidence that both the algal and heterotrophic populations are involved in the production of THM precursors. Aluminum sulfate was moderately effective for removing THM precursors from lake water. There seemed to be no relationship between alum's effectiveness and the population densities of algae and bacteria, but the effectiveness on a diurnal basis as algal growth varied was not evaluated.
W83-01279

OPERATIONAL EXPERIENCES WITH A PULSATOR CLARIFIER TREATING A COLOURED UPLAND WATER,
Strathclyde Regional Council (Scotland). Water Dept.
C. J. McFadzean.
Journal of the Institution of Water Engineers and Scientists, Vol 36, No 2, p 144-150, March, 1982. 3 Fig, 4 Tab.

Descriptors: *Color removal, *Clarifiers, *Water treatment, Corsehouse Treatment Works, Strathclyde Region, *Scotland, Pulsator clarifiers, Filtration, Sludge, Alum, Lime, Flocculation.

The semi-automatic Corsehouse Treatment works, commissioned in August 1976 by the Strathclyde Regional council, consists of coagulation, flocculation, sedimentation, clarification, filtration, chlorination, and pH correction. A typical raw water color is 120 degrees H, with some colors as high as 350 degrees H. The pulsator consists of a vertical flow clarifier. A centrally placed vacuum chamber receives water from the flash mixer and distributes the water to the pulsator through a system of

channels and perforated pipes near the floor of the tank. A vacuum pump in the chamber causes the water to rise to a predetermined level, at which the vacuum is broken and the water is expelled in a quick pulse through the channels and pipes into the tank. The duration of rise and fall of the water level has been 39-43 sec and 13-14 sec, respectively, over a flow range of 2200-5200 cu m per day, raw water colors of 60-350 degrees H, and water temperatures of 1 to 16 C. It appears that the pulsator is not necessary for control of the sludge blanket, but it reduces alum carry-over to the filters, increases the percentage of solids in the sludge drawn off, and allows quick return to stable conditions following adjustments. (Cassar-FRC)
W83-01302

CORRELATION PROCEDURES TO REDUCE WATER LOSSES (KORRELATIONSVERFAHREN ZUR WASSERVERLUSMINDERUNG),
Technische Werke der Stadt Stuttgart A.G. (Germany, F.R.).
H. Berge, and C. Laske.
Gas- und Wasserfach: Wasser/Abwasser, Vol 123, No 6, p 288-293, 1982. 11 Fig, 4 Ref. English summary.

Descriptors: *Correlation analysis, *Leakage, *Water loss, *Pipelines, *Networks, Water conveyance, Water pressure, Noise, Mathematical analysis, Water distribution, Drinking water, Stuttgart, Federal Republic of Germany.

Water losses of 14% (8 million cu m/yr) were occurring in the 2,100-km long pipe network of the City of Stuttgart (Federal Republic of Germany) Technical (Water) Works, prompting the use of a correlation procedure to locate leaks. This method is less susceptible to interference from outside noise and its results less dependent on the properties of the sounding equipment than the conventional 'bugging' method. The procedure works by means of pressure sensors which receive sound signals from one or two points along the pipe network and transmit them through a filter to a correlation analyzer. The analyzer performs cross-correlation when two signals are received and auto-correlation with one signal. The method uses the phenomenon that a leak produces pressure fluctuations in the water column that are transmitted to either side of the pipe and cause sound changes in both the fabric of the pipe and the water itself. Both water and pipe sound can be used for analysis; the reflection of water sounds in the pipe fabric may also be used with auto-correlation (one-point method). An example of the use of the two-point (cross-correlation) method with pipe sound is reported: analysis indicated the presence of a leak only 0.11 m from the actual leak. The one-point method with water sound, utilizing a reflection of the original sound, indicated a leak directly adjacent to the actual location. For the two-point method, a distance of 80-100 m between sensors is recommended. A deviation of + or - 0.7 m of the indicated leak from the actual location is considered acceptable, because then the actual leak will be uncovered by excavation. The one-point method is advantageous with long pipe sections, while the two-point method is better for intermeshed networks. The two-point method with pipe sound produces either an unmistakable indication or none at all. (Gish-FRC)
W83-01305

ACUTE FLUORIDE POISONING ASSOCIATED WITH AN ON-SITE FLUORIDATOR IN A VERMONT ELEMENTARY SCHOOL,
Vermont State Dept. of Health, Burlington.
For primary bibliographic entry see Field 5C.
W83-01329

THE U.S.: RETHINKING FILTRATION AND DISINFECTION,
Camp, Dresser and McKee, Inc., Boston, MA.
P. W. Prendiville.
Consulting Engineer (St. Joseph), Vol 59, No 3, p 79-82, September, 1982. 1 Fig.

Descriptors: *Drinking water, *Water treatment, *Water quality, Turbidity, Water treatment facilities, Europe, United States, Asbestos, *Filtration, *Ozonation, Adsorption, Carbon, Organic compounds, Public health.

Under the Clean Drinking Water Act, the EPA promulgated standards for maintaining turbidity levels of less than 1.0 units. Some states have set even stricter standards. If turbidity levels of under 1.0 units are required, water filtration is necessary. Filtration is also needed to guard against Giardia lamblia and Naegleria. Direct filtration plants using sand, coal, or dual media have been designed for large cities in the US and abroad. Filtration also removes the cause of primary amoebic meningoencephalitis and removes asbestos fibers from upland sources of surface water supplies. Filtration in many cases will not adequately remove organic precursors, and in such cases the adsorption of the organics on granular activated carbon can be considered. The combination of ozonation and direct filtration is being tried in Los Angeles to meet strict turbidity standards in a cost effective manner. The European water treatment philosophy is not only to treat poor quality water with sophisticated treatment trains but to produce drinking water similar in quality to natural spring water. (Baker-FRC)
W83-01331

EGHAM EXPANSION PROVIDES BULK WATER SUPPLY.
Water Services, Vol 86, No 1037, p 318-321, July, 1982. 6 Fig.

Descriptors: *Water supply, *Pumping stations, *Pipelines, Reservoirs, Case studies, Water treatment, Water distribution, Egham Works, North Surrey Water Company, *England.

A new reservoir and associated transmission lines were built to increase the water supply of the 90-year old Egham Works of North Surrey Water Company by 14 M liters per day. A new pumping station and upgrading of the rapid gravity filters increased throughput to 110 M liters per day, with provisions for a future expansion to 136 M liters per day. The plant draws its water from the River Thames and the groundwater-fed Queensmead Lake. A 900 mm cement mortar lined ductile iron pipeline over 20 km long was installed between the new Surrey Hill Reservoir and the treatment works. The reservoir, 110 m x 69 m x 6 m depth, will store about 45 M liters. (Cassar-FRC)
W83-01335

HYDROTEC - A GEOTEXTILE WATER WELL SCREEN,
R. H. Thomas.
Civil Engineering (London), p 35, 37, 38, July, 1982. 5 Fig, 1 Tab.

Descriptors: *Wells, *Screens, *Water quality control, Water pollution sources, Well screens, Well water, Drinking water, Potable water.

Recent attempts to improve the efficiency of well screens have usually centered on the development of screens having a higher open area ratio and the introduction of an artificially installed gravel pack. Both metallic and plastic screen types have been tried. Alternatively, the gravel pack solution allows the use of a coarser slot width in fine grained soils and relies on a pack of coarser material to retain the formation. Hydrotec was designed to overcome all basic problems, to provide a highly efficient well screen system that can be used in any kind of aquifer without recourse to a gravel pack. The screen consists of three plastic sleeves surrounding a central base pipe. The pipe provides support and high collapse resistance required by the well screen. The efficiency of the Hydrotec screens has been tested in the lab against commercially available well screens. Their efficiency has also been demonstrated in the field. (Baker-FRC)
W83-01345

PITLESS EQUIPMENT,
K. McCray.
Water Well Journal, Vol 36, No 9, p 48-49, September, 1982.

Descriptors: *Wells, *Equipment, Well regulations, Well casings, Regulations.

There are three types of pitless well equipment, designed to reduce well water contamination by surface runoff: the pitless adapter, the pitless unit and the above-ground discharge unit or diverter. The use of a pitless adapter requires digging a trench around the well casing to the lovel where the adapter connection will be made. This connection is below the soil freeze line. There are three basic adapter designs: compression gasket, saddle compression and weld-on style. Many models and brands of pitless equipment are on the market, but some states permit the use of only certain products. Contractors should contact state or local health officials to learn which are acceptable to their locality. (Baker-FRC)
W83-01349

TREATMENT TECHNOLOGY TO MEET THE DRINKING WATER STANDARDS FOR TRIHALOMETHANES FOR JACKSON, MISSISSIPPI,
Mississippi State Univ., Mississippi State. Dept. of Civil Engineering.
B. A. Mowry.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-146415, Price codes: A11 in paper copy, A01 in microfiche. PhD Thesis, May, 1982. 247 p, 43 Fig, 26 Tab, 59 Ref, 5 Append. OWRT B-029-MS(1). 14-34-0001-1240.

Descriptors: *Trihalomethanes, *Chlorination, *Disinfection, *Chloramines, *Drinking water, *Water treatment, Water quality, Potassium permanganate, Ozonation, Hydrogen peroxide, Ammonia, Jackson, *Mississippi, Pearl River, Chloroform.

The City of Jackson, Mississippi, acquires the bulk of its water from the Pearl River. Total trihalomethane (TTHM) concentrations in excess of the recommended level of 100 ppb have been found in the finished water. To arrive at an optimum solution to the TTHM problem, a study was initiated with the primary objective of delineating the most cost effective treatment sequence, meeting the EPA requirement for TTHM without sacrificing other water quality criteria. Studies on the removal of precursors, prevention of trihalomethane (THM) formation, and post treatment for the removal of tHM produced were carried out. Process modifications studied through pilot plant operation include: relocation of the chlorine application point; chlorination/ammoniation; chlorination/potassium permanganate oxidation; and chlorine dioxide utilization. Batch studies included: jar tests to determine the optimum conditions for coagulation; rate of THM formation studies to evaluate the effects of temperature, pH and chlorine dose on the rate of THM formation; aeration studies as a post treatment method for the removal of THM; and oxidation studies through ozone, hydrogen peroxide, chlorine dioxide and potassium permanganate to assess the effects of these oxidizers on precursors removal. Chloramines are the most cost effective and implementable option, as a substitute for prechlorination process, that will satisfy the objectives of controlling THM formation as well as providing the necessary disinfection. (Moore-SRC)
W83-01360

AN INVESTIGATION INTO THE REMOVAL OF ALGAE BY FINE SAND/SILT FILTRATION,
Louisiana Water Resources Research Inst., Baton Rouge.
For primary bibliographic entry see Field 5D.
W83-01367

5G. Water Quality Control

2,4,6-TRINITROTOLUENE-SURFACTANT COMPLEXES: DECOMPOSITION, MUTAGENICITY, AND SOIL LEACHING STUDIES,
Army Natick Research and Development Lab., MA.

For primary bibliographic entry see Field 5B.
W83-01067

THE DEFINITION AND USE OF MIXING ZONES,
Dow Chemical Co., Midland, MI.
W. B. Neely.
Environmental Science and Technology, Vol 16, No 9, p 518A-521A, 1982. 4 Fig, 1 Tab, 12 Ref.

Descriptors: *Mixing, *Wastewater disposal, *Outfalls, Water quality control, Destratification, Water pollution control. Wastewater.

A mixing zone is a region where dispersion occurs in all directions until the constituents in the discharge have achieved uniform concentrations in the receiving system. Mixing is important for effluent streams that contain a variety of chemicals. In the mixing zone water quality characteristics are established by determining how long the organisms will be exposed to the water and their response during this time. The boundary of the mixing zone is the point beyond which the response of the organisms to the water no longer depends on the length of time they are exposed. The mixing zone should be established by a combination of physical, biological, and political considerations weighed and used together to define the allocated impact zone. A numerical example is offered of how the effluent concentration may be estimated for a discharge to a typical river. Once the geometry of the mixing zone is known, it becomes possible to estimate the limitations that must be placed on the discharge to achieve the Water Quality Standard at the boundary of the designated zone. (Baker-FRC)
W83-01070

PROTECTING PUBLIC GROUNDWATER SUPPLIES,
J. Josephson.
Environmental Science and Technology, Vol 16, No 9, p 502A-505A, 1982. 2 Fig.

Descriptors: *Groundwater pollution, *Water pollution sources, *Waste disposal, Liners, Landfills, Waste dumps, Groundwater, Path of pollutants, Permeability, Leaching, Regulations, EPA.

Leachates from improperly constructed wastewater impoundments and waste disposal sites form a major threat to groundwater from which public drinking water and industrial water supplies are taken. With the primary aim of preventing contaminants from leaching out of waste disposal sites, EPA issued its long awaited regulations governing the placement of hazardous wastes in landfills, surface impoundments, and other repositories. The major regulatory provision requires liners of plastic or other synthetic material at landfills. Another provision calls for a backup leachate collection system to catch any hazardous liquids before they can reach groundwater. Various areas of study have been examined regarding liners, including tests on liner materials, liner caveats, clay liner tests and subterranean interactions when liners prove faulty. Use of digital computer models for predicting the migration of contaminants from their sources into groundwater is discussed. Means of assessing contamination are presented. (Baker-FRC)
W83-01071

CONTROL BY ALKALINE NEUTRALIZATION OF TRACE ELEMENTS IN ACIDIC COAL CLEANING WASTE LEACHATES,
Los Alamos National Lab., NM.
L. E. Wangen, and J. M. Williams.
Journal of the Water Pollution Control Federation, Vol 54, No 9, p 1302-1310, September, 1982. 1 Fig, 6 Tab, 9 Ref.

Descriptors: *Leachates, *Acidic water, *Metals, *Wastewater treatment, Industrial wastewater, Solubility, Coal wastes, Trace elements, Speciation, Adsorption, Neutralization, Lime, Model studies, MINEQL model.

The effect of calcium hydroxide neutralization of acidic coal cleaning waste leachates on the speciation of trace metals was calculated by a complex chemical equilibrium model (MINEQL) and compared with laboratory results. Good agreement was obtained for fluorides, Al, Ca, Fe(++), and Fe (3+). Model results were substantially higher than observed results for concentrations of the dissolved species, As, Cd, Co, Cr, Cu, Mn, Ni, and Zn. Concentrations of soluble components decreased with increasing pH over the range studied, 2.25-10.18. The alkaline neutralization of these leachates was an effective method of reducing pollutants. Al and Fe hydroxides, calcium sulfate, iron carbonate, calcium fluoride, and other solids present in the neutralized solution can also remove trace metals from solution by adsorption. (Cassar-FRC)
W83-01075

WATER QUALITY ASSURANCE BY PHOSPHORUS REDUCTION IN DRINKING WATER RESERVOIRS (SICHERUNG DER TRINKWASSERGUTE ALS FOLGE VON PHOSPHORELIMINIERUNGSMASSNAHMEN AND TRINKWASSERTALSPERREN),
Wahnbachtalsperrenverband, Siegburg (Germany, F.R.), English Summary.
For primary bibliographic entry see Field 5F.
W83-01114

ENVIRONMENTAL IMPROVEMENT ON NARRAGANSETT BAY AS A RESULT OF SECTION 312 IMPLEMENTATION OF THE FEDERAL WATER POLLUTION CONTROL ACT,
Rhode Island Univ., Kingston.
N. West, C. Heatwole, and L. Smith.
Coastal Zone Management Journal, Vol 10, No 1/2, p 125-140, 1982. 1 Tab, 13 Ref.

Descriptors: *Regulations, *Wastewater disposal, *Boating regulations, *Coastal zone management, *Narragansett Bay, *Rhode Island, Federal Water Pollution Control Act, Clean Waters Act, Recreation, Wastewater treatment, Toilets, Ships, Biological oxygen demand, Water pollution sources, Legal aspects.

A conceptual model was developed to evaluate the daily effluent load generated by recreational boats, which, like all vessels larger than 21 ft, are required to have Marine Sanitation Devices (MSD) as described in Section 312 of the Clean Waters Act. These regulations, which govern lakes and coastal waters, are intended to prevent untreated wastewater from entering the marine environment. A survey on Narragansett Bay, Rhode Island, during the summer of 1980 was used to develop the empirical model. Two types of MSD's require either an electric connection and/or addition of chemicals. They discharge treated effluents and chemicals to the receiving waters. The third type holds untreated waste until it can be pumped out at a shore facility. Calculated BOD per boating day was 3018 pounds, equivalent to a population of 686 persons. Costs were estimated for installing MSD's (at $100-$1500 each), shore pumping facilities ($2500-$3000 per year for 20 years), and treatment in municipal systems. These figures indicated that the cost of treating 1 pound of BOD was 30 cents. Potential adverse effects of enforcing these regulations are pollution from treatment chemicals (chlorine and compounds, formalin) and overloading of ill-equipped municipal sewage treatment plants. It is suggested that the regulations be applied on a geographical basis, exempting water bodies with good flushing action like Narragansett Bay, which are capable of efficient dilution and degradation of organic wastes at the levels generated there. (Cassar-FRC)
W83-01130

WASTEWATER TIGHT,
G. Ashfield.
Feedlot Management, Vol. 23, No. 4, p 6-7, 9, April, 1981.

Descriptors: *Feedlot runoff, *Feedlot wastes, *Waste management, Animal wastes, *Wisconsin, Farm wastes, Barn wastewater, Agricultural runoff, Manure, Construction, Terrace channels, Terracing, Land disposal, Water pollution prevention.

Efforts undertaken on a local farm in Darlington, Wisconsin, to improve water quality in the surrounding area are described. These efforts include the construction of two 200-head capacity feedyards, one with a 2 foot high retaining wall and the second with a 4 foot high retaining wall. The system effectively retains manure without the employment of a lagoon. About twice a month workers enter the concrete feedyards with a skid-steer loader, load the manure into a box spreader and spread it on nearby cropland. Liquid runoff from the feedyards passes through a picket section at the southeast corner of each yard. From there a gentle slope carries it down separate terraces, 140 and 176 ft in length. Most of the liquid runoff will be either absorbed or evaporated before reaching the far end, but in the event of a heavy rainstorm causing sufficient liquid to flow past the terraced section, a grass channel running along the south border of the field will halt the runoff and deny access to the many springs and streams in the area. (Baker-FRC)
W83-01141

WATER REGULATIONS,
League of Nebraska Municipalities, Lincoln.
For primary bibliographic entry see Field 6E.
W83-01144

A RIVER STUDY.
Soil and Water, Vol. 16, No. 6, p 14-16, December 1980. 1 Fig.

Descriptors: *Rivers, *Recreation, *Water resources development, Planning, Water quality, Water pollution control, Indusrial wastes, Fauna, *New Zealand, Waikato River.

The Waikato River in New Zealand flows for 14.5 km and drops three meters, with an average width of 80 meters. Dredging has created a uniform depth by deepening the western side of the river and preventing the buildup of sediment. Within Hamilton City the river has six small tributaries with banks of easily-erodible Hinuera sands. The main problems encountered are erosion and sedimentation . At present a wide range of organizations govern the use of an access to rivers and waterways. Because rivers are protected in a somewhat fragmentary way by wide range of Acts, the Commission for the Environment has suggested the introduction of a Wild and Scenic Rivers Protection Act to ensure that rivers will be protected, regardless of the wishes of other bodies or individuals. Due to industrial waste discharges and the past use of septic tanks in Hamilton, pollution has increased in the Waikato River. Improved treatment methods have brought the pollution level down considerably over the past few years. Now the area along the river is very beautiful in many spots, with paths along its banks creating restful places for recreation and relaxation, as developed by the Planning Council. (Baker-FRC)
W83-01150

THE RECOVERY OF L. VESIJARVI FOLLOWING SEWAGE DIVERSION,
Lahti Municipal Lab. (Finland).
J. Keto.
Hydrobiologia, Vol 86, No 1/2, p 195-199, January, 1982. 5 Fig, 2 Tab, 14 Ref.

Descriptors: *Lake restoration, *Sewage disposal, *Eutrophication, *Finland, Water pollution control, Water quality, Lake Vesijarvi, Primary productivity.

Lake Vesijarvi is part of the Kymijoki watercourse and is located in Paijat-Hame, Southern Finland, between the Salpausselka Ridges. The lake is divided into five basins. The aim of this study was to consider restoration of the polluted L. Vesijarvi, concentrating on the main basins, Enonselka and Kajaanselka. Originally the lake was clear water, oligohumic in nature due to the rich groundwater and spring drainage, but 60 years of discharging mechanically treated sewage into the southern part of the lake polluted its waters. Eutrophication was

observed as early as the 1920s, but in the 1960s the pollution became far more obvious. Sewage was completely diverted in 1976. As a result of the diversion the bacteriological defects were eliminated within one year, restoring the recreational value of th lake. The recovery of water quality was rapid during the first two years. The oxygen content increased markedly, but hypolimnetic oxygen depletion persisted. The phosphorus content decreased about 60% and the nitrogen content about 30%. After that period the recovery slowed down. The biomass of phytoplankton decreased, but the abundance of heterocystous blue-green algae increased, causing blooms in July and August. The primary production has lately been reduced despite the lack of improvement in chemical water quality. Hypolimnetic aeration was started in order to accelerate the recovery. (Baker-FRC)
W83-01158

CHANGES IN THE PHYTOPLANKTON OF LAKE TRUMMEN INDUCED BY RESTORATION,
Lund Univ. (Sweden). Limnological Inst.
G. Cronberg.
Hydrobiologia, Vol 86, No 1/2, p 185-193, January, 1982. 7 Fig, 15 Ref.

Descriptors: *Water management, *Lake restoration, *Water pollution control, Seasonal variations, Phytoplankton, Aquatic plants, Algae, Algal growth, Sediments, Lake Trummen, *Sweden, Dredging, Wastewater disposal, Industrial wastes, Water pollution sources, Fate of pollutants.

During 1930-1957 Lake Trummen, previously an oligotrophic lake, was heavily polluted. The drainage area for the lake is 13 sq km and consists of granites and till poor in lime and basic minerals. The lake during this century has received sewage and wastewater from a flax processing factory, with the worst pollution period falling between 1936-1957. Sewage was diverted from the lake in 1958, but the lake did not recover. Extensive restoration was carried out during the summers of 1970 and 1971. About 0.5 m of FeS-enriched sediment was removed through suction dredging, and the sediments were deposited in settling ponds beside the lake. Runoff water from the ponds was treated with aluminum sulfate in order to reduce the phosphorus concentration before it returned to the lake. In 1971 the shores were cleaned and the bulk of the macrophyte vegetation was taken away. Samples for phytoplankton and chemical analyses were taken monthly at the middle of the lake at 0.2 m depth. During the period 1968-1978 the phytoplankton showed similar seasonal variations. Before restoration blue green algae were most important in the Lake Trummen plankton community. In 1970 the biomass of blue-greens was reduced to 5% of the prerestoration values. Before restoration the sediments were periodically anaerobic; after restoration the oxygen conditions improved considerably. The disappearance of the blue-green algae may be a result of nutrient reduction, improved oxygen conditions and the elimination of spores. Restoration improved the conditions in the lake drastically and started a meiotrophication, which is still going on. The phytoplankton community now has much in common with adjacent oligotrophic lakes. (Baker-FRC)
W83-01159

THE ESTUARINE ZONE, AN OVERVIEW,
Canterbury Univ., Christchurch (New Zealand). Dept. of Zoology.
For primary bibliographic entry see Field 2L.
W83-01163

TUTIRA, A LAKE WORTH RESTORING,
Ministry of Agriculture and Fisheries, Auckland (New Zealand).
L. Teirney.
Soil and Water, Vol 16, No 1, p 10-13, February, 1980. 2 Fig.

Descriptors: *Lake restoration, *Environmental effects, *Eutrophication, Lake Tutira, *New Zealand, Recreation, Rehabilitation, Water quality, Nutrients, Phosphorus, Nitrogen, Nitrates, Ammonia, Oxygen, Seasonal variation, Oxygen depletion.

Lake Tutira, 35 km north of Napier (New Zealand), supports an abundance of wildlife, which adds to the appeal of the spot as a campground. A noticeable deterioration in the clarity of water occurred during the summer months in the 1960s. Studies made in 1970 confirmed that the lake was in an advanced state of eutrophication. With the plentiful supply of phosphorus, nitrogen, and other plant nutrients in Lake Tutira waters, conditions became very favorable for algal growth during spring. By November, the water below 10 m 70% of the lake's volume, was devoid of oxygen. Nitrates were converted to ammonia, which built up to toxic levels. Phosphorus was released from the bottom sediments. Hydrogen sulfide increased and accumulated. Attempts were made to maintain artificial mixing during the summer months. Water circulation was maintained through the use of aerohydraulic guns. Under these conditions complete deoxygenation did not occur until February, and it was restricted to depths greater than 23m, only 20% of the lake's volume. The use of the guns has undoubtedly improved the summer conditions in the lake. However, this technique treats the effects of the problem rather than the cause and is only temporary. Improved land use and management practices will help provide a long range solution to the problem. (Baker-FRC)
W83-01165

SALINE GROUND-WATER DISCHARGE TO THE SMOKY HILL RIVER BETWEEN SALINA AND ABILENE, CENTRAL KANSAS,
Geological Survey, Lawrence, KS. Water Resources Div.
J. B. Gillespie, and G. D. Hargadine.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-237637, Price codes: A04 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 81-43, 1981. 71 p, 31 Fig, 3 Tab, 25 Ref.

Descriptors: *Saline water intrusion, *Groundwater movement, *Water pollution sources, *Degradation, Surface-groundwater relations, Aquifer characteristics, Geohydrology, Hydrologic properities, Subsidence, Mathematical models, Observation wells, Water sampling, *Kansas, Smoky Hill River, Solomon River.

Saline water discharges from the alluvium into the Smoky Hill and Solomon Rivers near Salina, Kansas, at about 32 cubic feet per second. Chloride concentrations at base flow increase about 800 milligrams per liter in the Smoky Hill River and 550 milligrams per liter in the Solomon River. The source of the saline water is the underlying Wellington aquifer, a zone of dissolution, subsidence, and collapse that occurs along the eastern margin of the Wellington Formation. Locally brine from the aquifer moves upward through collapse structures in the confining layer at the base of the alluvium. The brine discharge ranges from 0.3 to 0.8 cubic foot per second and the chloride load ranges from 150 to 370 tons per day. Results from a mathematical model of the flow system indicated that recharge from periodic flooding, as in 1973, was sufficient to reverse the normal (1976-77) hydraulic gradient between aquifers. Although brine discharge was temporarily reduced, saline-water discharge to the rivers was increased. Brine in the Wellington aquifer could be intercepted by wells and pumped to deep formations or stored for release to the river during high flows. The freshwater in upstream base flow could be diverted, and saline-water discharge could be retained by low-head dams in the channel for release during high flows. (USGS)
W83-01191

EFFECTIVENESS OF SEPTIC SYSTEMS IN SAFEGUARDING THE GROUNDWATER IN MAINE,
Maine Univ. at Orono. Dept. of Plant and Soil Sciences.
R. W. Black, and R. A. Struchtemeyer.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-140004, Price codes: A04 in paper copy, A01 in microfiche. Completion Report, Maine Land and Water Research Center, Orono, Aug 1982. 57 p, 19 Fig, 13 Tab, 79 Ref. OWRT A-052-ME.

Descriptors: Domestic wastes, *Groundwater protection, *Septic tanks, Septic wastewater, *Maine, *Soil adsorption systems, *Groundwater pollution, Suction lysimeters, Monitoring, Water pollution control, Plumbing codes, Nutrients, Pollutant identification.

In 1974, Maine's External Plumbing Code was revised to require on-site inspection by a Licensed Plumbing Inspector, rather than a 'perc test,' for sizing and designing subsurface soil absorption systems. Since that time, over 30,000 new systems have been installed. In this study, field monitoring of the groundwater around selected systems was conducted in order to detect potential contamination from domestic effluent. Twenty-eight test systems were selected, representing seven code-designated 'Soil Groups' and two construction calendar years, 1975 and 1977. Suction lysimeters provided water samples for NO3-N, NH4-N, PO4-P, pH, COD, and Cl- analyses. Monitoring occurred from June through October of 1980 and in March of 1981. Considering all systems, NO3-N concentrations under or within 3.1 meters of the bed ranged from 0.3 ppm to 410 ppm; NH4-N from 1.0 ppm to 126 ppm; and PO4-P from 0.003 ppm to 28.950 ppm. Within this 3.1 meter distance, 71 percent of all sites exceeded the U.S. Public Health Service drinking water standard of 10 mg/l NO3-N, and 86 percent exceeded the U.S. EPA surface water standard of 0.025 mg/l PO4-P at some time during the sampling period. Of the 61 systems reviewed, 51 percent were not installed according to Code specifications, even though they had been designed properly.
W83-01278

RECENT INVESTIGATIONS ON THE EUTROPHICATION AND RESTORATION OF LAKE CONSTANCE (NEUERE UNTERSUCHUNGEN UBER DIE EUTROPHIERUNG UND SANIERUNG DES BODENSEES),
Konstanz Univ. (Germany, F. R.) Limnology Inst.
H-J. Elster.
Gas- und Wasserfach: Wasser/Abwasser, Vol. 123, No. 6, p 277-287, 1982. 8 Fig, 55 Ref. English summary.

Descriptors: *Eutrophication, *Phosphorus, *Lake restoration, *Water quality control, *Lake Constance, Phosphorus removal, Seasonal variation, Limiting nutrients, Wastewater treatment, Primary productivity, Phosphates, Eutrophic lakes.

The present condition of Lake Constance (Federal Republic of Germany, Switzerland, and Austria) and its outlook for the future are discussed in the light of findings by the German Research Association and the International Commission for the Protection of Lake Constance (ICPLC). In January 1981 83.5% of the population equivalents in the lake's catchment area were served by wastewater-treatment facilities, and 68.5% were served by facilities with phosphorus (P) precipitation. The exponential increase of P concentration that occurred from 1950 to 1975 has reached a plateau of 80-90 microg P04-P/1. During summer stagnation, P is the most important limiting nutrient, while nitrogen and, for diatoms, silica may become limiting periodically. The key to restoration is a radical reduction in the input of P compounds that can be assimilated. A 90% reduction in P concentration is necessary to achieve oligotrophy; this corresponds to amounts present in the lake 40 years ago. Approximately 2/3 of the P in the lake originates in wastewaters, the rest stemming from sources such as agriculture and the atmosphere. Even if 90% of the wastewater P were eliminated, an oligotrophic state would not be achieved, due to anthropogenic nonpoint P sources. However, if efforts to replace phosphates in detergents by substances that do not cause eutrophication are successful, the lake may be saved from reduction processes in the sediment surfaces and their consequences. The ICPLC restoration plan must be carried out without compromise, and an extensive general water-protection plan for the entire catchment area is needed. The agricultural community must become involved, and water protection should be considered by tourists, watersport enthusiasts, and new industries. (Gish-FRC)
W83-01321

MOBILIZATION OF COPPER FROM MODIFIED PEAT BY DISSOLVED ORGANIC MATTER IN NATURAL WATERS AND BIOLOGICALLY PURIFIED WASTEWATERS,
Agricultural Univ., Wageningen (Netherlands). Dept. of Water Pollution Control.
For primary bibliographic entry see Field 5B.
W83-01341

SLIPLINING ENDS GADSDEN INFILTRATION.
American City and County, Vol 97, No 9, p 79-80, September, 1982.

Descriptors: *Sewer systems, *Leakage, *Maintenance, Leakage, Water loss, *Sliplining, Linings, Sink holes, Sewer infiltration, Infiltration.

Sink holes caused by the infiltration of soil into leaks in portions of sewer lines have been eradicated by sliplining a 2000 foot section of poorly supported sewer pipe. In effect, a new pipe was placed inside an old one. At one point pipe was heat fused into a 1000 foot flexible length. A winchline was connected to the pipe end, and the entire 1000 feet was pulled through the existing concrete pipeline. The entire 2000 foot sliplining project was completed in 48 hours. Proper preinstallation planning eliminated any inconvenient sewer system cutoff to residences. (Baker-FRC)
W83-01344

OPINION,
G. Read.
Civil Engineering (London), P 12-13, 45, August, 1982.

Descriptors: *Sewage systems, *Maintenance, *Collapse, Mechanical failure, Leakage, Sewers, Human disease, Public health, Bacteria, Overflow.

Sewer dereliction is a problem common in many cities such as Manchester, England. Sewer collapses occurring in the city necessitated a study of sewer conditions and neglect. Falling brickwork, partial collapse and resultant backing-up lead to premature overflow to the watercourses, which often run through densely populated residential area, and the health risk is obvious. Many older properties have cellars with drains leading to the sewerage system, where flooding results even after a partial collapse. Various means are considered to renovate the sewers. Relining is appealing due to cost savings and minimization of disruption, but results may not be satisfactory. The main goal must be to get the work done, and the responsibility must lie with the District Engineers. (Baker-FRC)
W83-01346

USEFULNESS OF SEDIMENT OXYGEN AS A TOOL FOR IMPOUNDMENT MANAGEMENT,
Illinois State Water Survey Div., Champaign.
For primary bibliographic entry see Field 5B.
W83-01371

6. WATER RESOURCES PLANNING

6A. Techniques Of Planning

STOCHASTIC APPROACH TO EVALUATING THE EFFECTIVENESS OF RECLAMATION MEASURES,
Akademiya Nauk SSSR, Moscow. Fiziko-Tekhnicheskii Inst.
D. D. Frolkin.
Water Resources, Vol 8, No 5, p 477-483, September-October, 1981. 5 Fig, 1 Tab, 10 Ref. Translated from Vodnye Resursy, No 5, p 29-36, September-October, 1981.

Descriptors: *Crop production, *Computer models, *Mathematical models, *Capital costs, *Stochastic process, *Land reclamation, Dynamics, *Crop yield, Evaluation, Agronomy, Irrigation operation, Model studies, Water resources development, Numerical analysis, Planning.

The possibilities of formalizing the effectiveness of capital investments in reclamation measures for agricultural production and providing a numerical solution are studied. An algorithm is illustrated using an individual economic region with one agricultural crop. Relations are given to describe the dynamics of capital investments and irrigation. Four models are given which contain variables of both the water-resource block and the agricultural block and can serve as links in the system of models for the effective use of water resources. Reclamation measures are evaluated beforehand by modeling the random variables on a computer. In the final formulation, the solution represents the sum of the deterministic and stochastic components, where the stochastic component of the solution corrects the deterministic component during practical realization of the selected variant of development and takes into account the annual changes in crop yield. The predictions obtained for optimal cropland to be planted and storage facilities needed for the harvest can be used for making decisions about investments in the current year. (Geiger-FRC)
W83-01093

EXPANSION PLANNING OF WATER SUPPLY PROJECTS IN TEGUCIGALPA, HONDURAS (AUSBAUPLANUNG VON WASSERVERSORGUNGSPROJEKTEN IN TEGUCIGALPA, HONDURAS),
Lahmeyer International G.m.b.H., Frankfurt am Main (Germany, F.R.).
H. Lutkestratkotter, and F. G. Rohde.
Wasserwirtschaft, Vol 72, No 6, p 246-249, 1982. 6 Fig, 2 Tab, 5 Ref. English summary.

Descriptors: *Water supply development, *Long-term planning, *Cost analysis, *Water resources development, Water conveyance, Water districts, Planning, Project planning, Projections, *Honduras, Tegucigalpa, Water treatment, Economic aspects, Estimated costs, Mathematical models, Model studies.

A master plan was developed to ensure an adequate water supply for the city of Tegucigalpa (Honduras) to the year 2010, when the population is expected to reach 1.9 million, up from 375,000 in 1980. During the same period water requirements are expected to increase from 80,000 to 550,000 cu m/day. The plan included the incorporation of new raw water sources, water treatment, conveyance from the supplying area, and the division of the district into eight zones from 950 to 1,300 m above sea level. It sought to minimize all fixed and variable costs falling due within the planning period and used as an aid a mathematical-numerical optimization model based on mixed whole-number linear programming. The program provided information showing in which year each available water source would have to be incorporated into the system in order to ensure the supply, the amount of water required from each source and the specific costs attached thereto (including construction and maintenance of pipelines and water treatment facilities), and costs divided according to fixed, variable, and specific costs. Annual total costs were divided according to treatment facility, and it was seen that two plants would incur high variable operation costs due to the necessity of conveying groundwater to them over large distances and height differentials. To minimize total costs it was therefore decided to decrease the water volume required from these plants as soon as new, less expensive plants were operational. All costs were calculated based on a 12% interest rate, though actual costs will depend on the rate at which the state is given credit; these problems were treated in a financial study as part of the master plan. Due to the preponderance of investment cost as compared with variable costs, no influence was expected to be exerted by interest rates on investment decisions. (Gish-FRC)
W83-01343

6B. Evaluation Process

EFFICIENCY OF RESOURCE USE UNDER SMALL-SCALE IRRIGATION TECHNOLOGY IN NIGERIA,
Purdue Univ., Lafayette, IN. Dept. of Agricultural Economics.
P. O. Erhabor.
Technical Report No 148, Purdue University, Water Resources Research Center, June 1982. 114 p, 16 Fig, 39 Tab, 48 Ref.

Descriptors: *Irrigation, *Economic development, *Developing countries, *Linear programming, Surface irrigation, Groundwater level, *Nigeria.

Northern Nigeria is subject to periodic droughts that limit food production and increase food imports into the country. A econometric study was conducted to estimate the economic returns from adoption of small scale irrigation methods (shadoof and pump) and to indicate implications of these returns for research, extension, and government policy. A modified linear programming model was used that accounted for inputs and returns from intercropping systems. The data necessary to estimate the coefficients or parameters of the model were obtained from 114 irrigation farmers in Ringim LGA, Kano, Nigeria during the 1978/79 irrigation season. The results of the study indicated that the returns to irrigation farming with the shadoof and pump irrigation technology are quite high. Thus the benefits from promoting these small scale lift devices are worthy of consideration by policymakers interested in increasing agricultural output. A major barrier identified as limiting the expansion of irrigated land area was unavailability of water. Although there is sufficient ground water, the amount currently accessible for irrigation with pumps and shadoofs is limited. Investment in wells and ponds could increase availability. Lack of timely repair service hinders adoption of pump irrigation at present. (Nelson-Purdue WRRC)
W83-01083

INFILTRATION WELL USED IN HARDWAR WATER SUPPLY,
UP Jal Nigam, Hardwar (India).
J. P. Nigam.
Journal of the Institution of Engineers (India), Part EN, Environmental Engineering Division, Vol 62, No 2, p 84-88, February, 1982. 4 Fig, 2 Tab, 2 Ref.

Descriptors: *Well water, *Water supply, Water resources development, *Infiltration wells, Chlorination, Drinking water, Financial aspects, Cost analysis, *India, Hardwar.

The construction cost of tubewells for drinking water is very high in places such as Hardwar, where boulder stratum is located in the upper surface and rocky stratum in the deeper surfaces. Even so a poor discharge results of about 2,250 l/m (500 g/m). In the presence of any stream, construction of infiltration wells is less expensive and the discharge is high. Design of such infiltration wells depends on the discharge, groundwater level and the distance of the well from the stream. The site of the well should be selected so that the water or stream has the minimum chance to become polluted. In Hardwar two infiltration wells were constructed, and their performance is reported. Based on the characteristics of one well, depth of other wells may be designed at different distances from the stream for different discharges in such strata. Samples of water from these wells were tested and found satisfactory. The potable water may be supplied from these wells after chlorination only. (Baker-FRC)
W83-01301

WATER TRANSFER STRATEGY: ENERGY VS. AGRICULTURAL USE,
Hawaii Univ. at Manoa, Honolulu. Water Resources Research Center.
Y. S. Fok, and C. P. Chang.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-146399, Price codes: A05 in paper copy, A01 in microfiche. Technical Report No 142, March 1982. 81 p, 9 Fig, 34 Tab, 8 Ref, 7 Append. OWRT B-060-HI(1). 14-34-0001-9110.

Descriptors: *Irrigation water, *Energy, *Water transfer, *Arid lands, *Water rights, *Resources

development, Social impact, Economic aspects, Cost analysis, Water use.

In some arid and semiarid regions where most water is appropriated for irrigation, water has been recognized as the most important limiting factor for energy development. Therefore, a water transfer from agricultural to energy use should be considered, since industry yields the highest value of water and thus constitutes the highest productivity. A transfer of the available water from agriculture to industry or energy in communities which are basically agricultural would tend to upset the familiar pattern of life and would result in a number of social costs to farmers and third parties. The developable amount of energy deposits, or the results of optimization, at a specified region (reach) depends on the unit energy developing cost, required kinds and levels of energy, amount of water-right-use streamflow existing at the proposed reach and other reaches, and the costs of transferring irrigated lands in the entire watershed. The required acreage of transferred irrigated lands increases as the total energy requirement increases. The incremental acreage per unit energy requirement varies for different compositions of total energy sources. To decrease the energy cost of agricultural water right reimbursement, energy developers can sell over-transferred water rights to downstream users from the reach where no more energy water is needed. Locations of extractive energy sources are fixed; however, conversion factory sitescan be in regions that have abundant water ana are close to the extraction site. (Moore-SRC)
W83-01358

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

FINANCIAL PLANNING DURING TIMES OF ECONOMIC UNCERTAINTY,
Economic and Engineering Services, Inc., Bellevue, WA.
G. S. Seleba.
Journal of the American Water Works Association, Vol 74, No 9, p 14, 38, September, 1982.

Descriptors: *Financing, *Bond issues, *Water rates, Economic aspects, Interest rates, Planning, *Utilities, Pricing, Operating costs, Debt, Costs.

Skyrocketing expenses and governmental regulations have forced water utility managers to seek additional sources of revenue. Some of the traditional revenue sources are long-term debt (general obligation bonds, special assessment bonds, and revenue bonds), equity offerings, and grant funds. About 1970 the financial climate changed for water utilities. Changes in laws precluded additional financing with general obligation bonds. Grant funds dwindled, and interest rates increased. New environmental regulations, increased construction costs, lack of new technology, construction delays, and inflation precipitated a shift from declining block rates to flat rates or inverted rate structures. Some strategies for internal expense control are reducing labor costs, scheduling construction for off-peak seasons, saving energy by retrofitting pumping stations with new equipment or by taking advantage of off-peak electric rates, and expediting billing. Possible internally generated revenue sources are higher minimum bills, an initial monthly fee, seasonal water rates, and new user charges. Innovative methods of external financing include offering attractive bonds through floating rate bonds, put bonds, warrants, and tender offerings. (Cassar-FRC)
W83-01054

FUNDING IMPROVEMENTS WITH DEBT CAPITAL AND REVENUES,
Burns and McDonnell, Kansas City, MO.
W. N. Marshall.
Journal of the Americal Water Works Association, Vol 74, No 9, p 456-459, September, 1982. 4 Fig, 1 Tab.

Descriptors: *Financing, *Economic aspects, *Capital costs, Debt, *Utilities, Construction costs, Interest rates, Bond issues, Income, Water rates, Planning.

A water utility can fund major capial improvements with a combination of bond proceeds and revenues which will minimize cash requirements and impose the lowest rate increases. Benefits of joint funding are more apparent at higher interest rates, for higher case coverage requirements, for lengthy construction programs, and for utilities with low bond ratings. A formula is given to calculate the optimum amount of new debt: D = (K1 x Ct) - n x K1 x K2 x DCs. K1 = fi(fc - 1 - k) where fi = debt service factor depending on interest rate and term of loan. fc = coverage factor, k = reciprocal of number of years required to fill the debt service reserve fund. Ct = D + nCr, where Ct = cost of total capital additions, D = debt, n = number of years for construction program, and Cr = improvements paid for from annual revenues. K2 is a function of fc and the payments to the reserve fund on existing obligations, and DSc is the maximum annual debt service on al existing debt. The cash coverage factor and number of years required for construction completion exert a greater influence on the optimum amount of debt than do interest rates. (Cassar-FRC)
W83-01055

CREATIVE FINANCING TECHNIQUES FOR WATER UTILITIES,
John Nuveen and Co., Inc., Chicago, IL.
P. C. Williams.
Journal of the American Water Works Association, Vol 74, No 9, p 443-449, September, 1982. 1 Fig, 5 Tab, 2 Ref.

Descriptors: *Financing, *Economic aspects, *Bond issues, *Utilities, Capital costs, Debt, Interest rates, Insurance, Investment, Loans, Planning.

Contemporary methods for financing water utility capital expansions and improvements are reviewed. In recent years the bond market has become increasingly volatile. Individuals and families are becoming a more important force in the bond market as investments by banks and insurance companies have declined. Negotiated bond sales have increased from 33% to 75% of total volume in the past 5 years. Some creative or innovative interim financing methods (short-term or temporary) include bond anticipation notes (maturing in 1-3 years and payable solely from the proceeds of a long-term bond issue), secured bond anticipation notes, direct bank loans (at rates 60-85% of the bank's prime lending rate), commercial paper (15-45 days maturity), and variable rate demand notes (maturity 2-3 years with weekly fluctuating interest rates). A table summarizes payment source, additional security, maturity, interest rates, other costs, and advantages and disadvantages of each interim financing technique. Some longterm bond financing alternatives are tender option bonds (put bonds), which are usually limited to 10-25% of the total bond issue; floating rate bonds, in which interest varies with the market; tender option bonds with adjustable rates; municipal bond insurance, often saving 1/4 to 3/8 of 1% in interest over 20-25 years; original issue discounts, a long-standing provision increasingly used by municipalities; zero coupon bonds, sold at 3-20% of par value in return for no interest; stepped coupon bonds, with interest rates increasing each year, perhaps from 8% the first year to 20% or more in the 25th year; and bonds with warrants attached (options to buy an additional bond at the same rate within 1 year). To suit the needs of investors, some municipalities offer their bond issues in several packages with different types of financing. (Cassar-FRC)
W83-01056

THE ROLE OF INVESTMENT BANKING FIRMS IN MANAGING WATER PROJECT FINANCING,
Lehman Bros. Kuhn Loeb, Inc., NY.
F. C. Starr, and R. W. Forbes.
Journal of the American Water Works Association, Vol 74, No 9, p 451-455, September, 1982. 3 Tab.

Descriptors: *Financing, *Economic aspects, *Investment, *Utilities, Bond issues, Debt, Planning.

The primary business of an investment bank is to assist its clients in establishing and implementing a financing strategy. The current volatile bond market and uncertain economic conditions have made investment services a decisive market and uncertain economic conditions have made investment services a decisive factor in maintaining fiscally sound water services. The main functions of an investment banker, who is not a banker but a financial intermediary, are financial advice and counsel, risk-bearing services (i.e., underwriting), and distribution of securities through a marketing staff. The history of a typical new bond issue is followed through preunderwriting conferences, activities of the underwriting syndicate, offering and sale of the securities, and stabilizing the price of the issue. The two common methods of underwriting in the tax-exempt bond market are negotiated sales and competitive bidding. Each has its advantages and disadvantages. During the past 10 years the volume of negotiated sales has increased from 28% to 61% of municipal financing. There has been renewed emphasis on strategic financial planning which must begin in the earliest stages of project evaluation. After a bond sale, investment bankers can continue in an advisory role. Post-sale activities include developing strategies for managing sinking fund retirements, assisting in reviews for possible bond rating upgrading, and providing related financial services such as investments for cash management purposes. (Cassar-FRC)
W83-01081

AN ECONOMIC EVALUATION OF INTERBASIN WATER TRANSFERS: A CASE STUDY OF SOUTHWESTERN CONNECTICUT,
Connecticut Univ., Storrs. Insti. of Water Resources.
L. R. Fattarusso Jr.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-139907, Price codes: A06 in paper copy, A01 in microfiche. M. S. Thesis, 1982. 108 p, 4 Fig, 7 Tab, 54 Ref, 2 Append. OWRT A-086-CONN(2).

Descriptors: *Interbasin transfers, *Water allocation, *Cost analysis, *Model studies, *Water requirements, *Water supply, Connecticut, Water transfer, Economic aspects.

In 1980, a survey of southwestern Connecticut's major water companies was initiated to obtain information regarding water requirements and supply estimates and cost informatin. An economic analysis of te water supply problem facing the region (Fairfield County and the town of New Milford) was undertaken to determine optimal water allocation for the study area. Supply and water requirements estimates were obtained for 1979, and these estimates were projected for the years 1985 and 2000. Ninty-four water supply sources (both existing and proposed), 23 requirement areas and all potentially feasible water supply schemes were identified. A linear programming model of the transportation type was developed to determine the optimal regional water allocation scheme. The least cost method of supplying southwestern Connecticut with potable water to meet its water requirements was determined for the years 1979, 1985, and 2000. It was found that the total cost of supplying water can be reduced by using an optimization model to plan water allocations on a regional basis. By the year 2000 even under the most conservation water requirement scenario there will be a water deficit in southwestern Connecticut unless proposed water sources are developed. (Moore-SRC)
W83-01271

A PRICING POLICY FOR GROUNDWATER MANAGEMENT IN PUERTO RICO,
Puerto Rico Univ., Mayaguez. Water Resources Research Inst.
R. Ramgolam, and R. A. Rios.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-139980, Price codes: A04 in paper copy, A01 in microfiche. Report, February 1982, 56 p, 5 Fig, 7 Tab, 21 Ref, 1 Append. OWRT A-055-PR(1).

Descriptors: *Pricing, *Pumping, *Groundwater management, *Mathematical models, *Puerto

Rico, Economic aspects, Groundwater depletion, Water users, Cost analysis, Energy.

The effect of irrational withdrawals of groundwater is being felt throughout Puerto Rico, particularly in areas where the quatity demanded is approaching or already exceeds the quantity supplied. The aim of this study is directed towards the internalization of external costs which fall upon estabiched water users through the pumping of ground water from a common-pool by new water users. It is rationalized that these external costs to established users manifest themselves in additional pumping costs which are reflected primarily in incurrence of added energy costs. The determination of these costs which constitutes the basis of a price levied on new users and consequent compensation to established users was achieved through the development of a mathematical model. Through this model it is shown that: the greater the quantity of water extracted by new users, pumping (additional) costs were higher for established users; the greater the distance between two wells, the additional pumping costs were correspondingly less for established users; and when the distance is greater than the radius of influence (3,500 ft) no additional pumping costs were incurred. (Moore-SRC)
W83-01276

SETTING EQUITABLE WATER RATES,
Black and Veatch, Kansas City, MO.
C. W. Keller.
Consulting Engineer (St. Joseph), Vol 59, No 3, p 96-102, September, 1982. 4 Tab.

Descriptors: *Water rates, *Pricing, *Water use, Water supply, Water demand, Planning, Water metering.

At present most water rates are based on a monetary charge per unit of volume, that is, a certain number of cents per thousand gallons or hundred cubic feet, with or without a decline or increase in the charge as water consumption increases in the billing period. In early American water utility practice water use was not measured by meter. There are three basic steps in water rate determination. The first is to determine revenue requirements, or the total annual amount the utility must derive from rates. The second step is to allocate cost to the various customer classes such as residential, commercial, and industrial. The third step is the actual design of rates so that the cost can be recovered and the utility receives the total revenue it needs. Recent developments include consideration of marginal cost pricing, sociological pricing, time differential pricing, pricing to conserve water use including inverted rate schedules, and substantial connection fees for new customers. (Baker-FRC)
W83-01330

COSTS OF PREVENTIVE MAINTENANCE PROGRAMS IN WASTEWATER COLLECTION SYSTEMS,
Burns and Roe Industrial Services Corp., Paramus, NJ.
For primary bibliographic entry see Field 5D.
W83-01339

EXPANSION PLANNING OF WATER SUPPLY PROJECTS IN TEGUCIGALPA, HONDURAS (AUSBAUPLANUNG VON WASSERVERSORGUNGSPROJEKTEN IN TEGUCIGALPA, HONDURAS),
Lahmeyer International G.m.b.H., Frankfurt am Main (Germany, F.R.).
For primary bibliographic entry see Field 6A.
W83-01343

6D. Water Demand

EFFICIENCY OF RESOURCE USE UNDER SMALL-SCALE IRRIGATION TECHNOLOGY IN NIGERIA,
Purdue Univ., Lafayette, IN. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 6B.
W83-01083

WOOD AND WATER,
K. Johnston.
Soil and Water, Vol 17, No 2, p 7-9, April, 1981.

Descriptors: *Forestry, *Water resources development, *Hydrology, Water supply, Water demand, Available water, Water level, Forest watersheds, Erosion control, Forest management, Clearcutting, Forest hydrology, *New Zealand.

New Zealand is expected to see a massive increase in its forestry industry, with a seven-fold increase in forestry exports and another one million hectares planted in exotic forests after the turn of the century. Doubling the area of forests will have a great impact on local soils and hydrology. What will be done with these new trees and those already planted is a telling question for New Zealand's water resources. How the trees will be tended during their first decade of life will determine how much clearwood is available for structural timber or how much is good for only pulping, panels or energy production. The choices made will have a great impact on the development of the industry and of the demands made for water. One major question is whether there is enough water available to meet the demands of pulp mills and still continue to meet other industrial, agricultural, recreational, wildlife and fisheries needs. Recycling of water was advanced as a potential solution to part of the problem. The effects of afforestation on soil stability differ significantly from site to site. It is noted that burning and clearing pre-existing vegetation prior to planting substantially increases the water yield for two to three years. Destocking of pasture to permit planting decreases water yield. Growth of forests results in decreases in annual water yield lower-quartile flow, flood peaks and storm runoff. Groundwater levels rise following thinning or clearfelling. An equation is given for estimating the increase in annual water yield following harvesting of a forest, knowing the annual rainfall. (Baker-FRC)
W83-01171

WATER TO PLAY WITH,
Taranaki Catchment Commission (New Zealand).
J. Hutchings.
Soil and Water, Vol 17, No 2, p 4-6, April, 1981. 3 Fig.

Descriptors: *Recreation demand, *Water resources development, *Planning, Water use, Water demand, Recreation facilities, Fishing, Diving, Swimming, *New Zealand, North Taranaki.

The growth in competition between industrial, residential, agricultural, and recreational water demands has heightened the need for water resource planning in North Taranaki. In such planning, it is difficult to establish the needs of the recreational user. Recreation implies a recognition of esthetic rather than economic values and an appreciation of the qualitative aspects of life as opposed to the quantitative. Offshore, coastal and river waters available for recreational use were evaluated by selecting certain criteria considered relevant in contributing to the attractiveness of the resource to the population and important in affecting the choice of any recreational water resource used. A number of recommendations resulted from this assessment of recreational use of water. Coastal waters and areas provide ample opportunities for fishing, diving, and swimming. The Waitara River scored poorly in terms of its scenic appeal, but the range of activities and the unique nature of the river for particular activities resulted in its being ranked the most important recreational river resource in the area. (Baker-FRC)
W83-01172

MODERNIZING IRRIGATION SYSTEMS IN ALBERTA,
Department of the Environment, Edmonton (Alberta). Div. of Design and Construction.
For primary bibliographic entry see Field 4A.
W83-01232

AN ECONOMIC EVALUATION OF INTERBASIN WATER TRANSFERS: A CASE STUDY OF SOUTHWESTERN CONNECTICUT,
Connecticut Univ., Storrs. Insti. of Water Resources.
For primary bibliographic entry see Field 6C.
W83-01271

WATER DEMAND ON THE RAKAIA,
D. Leather.
Soil and Water, Vol. 16, No. 3, p 17-21, June, 1980. 2 Fig.

Descriptors: Water resources development, *Planning, Computers, Model studies, Irrigation projects, Rakaia River, Fisheries, Fish, *Water demand, *New Zealand.

A recent report on water use and irrigation development on the Rakaia River (New Zealand) is discussed, with emphasis on the issues which arise over the potential exploitation of the Rakaia. Of all the Canterbury rivers, the Rakaia provides the greatest water resource, with a mean annual flow of 196 cubic meters per second at the Rakaia Gorge. There are 21 species of fish found in the Rakaia River. An irrigation demand assessment study was carried out for the Central Plains and Lower Rakaia Schemes. Using a computer model, soil moisture levels were simulated and irrigations applied where needed. Estimates of average demand and demand peaks were made for the 11 irrigation seasons and for 7 different crops on 5 different soil types. Regardless of what level of development occurs on the Rakaia, there is a need for information on its fisheries and wildlife resources. Through use of the Incremental Method basic information is obtained from specific point transects at representative sites across which the investigative team traps extensively for fish and samples for invertebrates. Further hydrological information will also be collected. If the Lower Rakaia Scheme is developed, it is hoped that it will be sufficiently flexible to allow reduced abstractions for periods of two or three weeks during times of critical flows in the river. (Baker-FRC)
W83-01315

PLANNING FOR DROUGHTS,
Metcalf and Eddy, Inc., Boston, MA.
L. A. Edmonds, and S. L. Bishop.
Consulting Engineer (St. Joseph), Vol 59, No 3, p 90-94, September, 1982. 1 Fig, 1 Tab.

Descriptors: *Droughts, *Water supply, *Planning, Water resources development, Drinking water, Water stress, Gloucester, Rockport, *Massachusetts, Water conservation, Conservation, Water management, Management.

To avoid adverse impacts, communities and water authorities must plan for droughts. Such planning has two basic concepts: first, using various means of decreasing or suppressing water use, and secondly, tapping emergency sources of water supply. Several actions every water purveyor should consider are: to obtain and keep up-to-date information on existing water supplies and water usage; reduce unnecessary losses from the system; develop an emergency drought management program, identifying how demand may be forcibly reduced, as needed, by applying water use restrictions; identify and evaluate emergency sources of water supply; develop a water conservation program that includes an active citizen education element; manage water supplies intelligently to optimize all existing sources; and review water rate structures to verify that they are equitable, adequate, and promote conservation. Water plans of the cities of Gloucester and Rockport, Massachusetts, are reviewed. (Baker-FRC)
W83-01347

6E. Water Law and Institutions

LEGAL ISSUES IN IMPLEMENTING WATER REUSE IN CALIFORNIA,
California Univ., Berkeley.
E. C. Brown, and N. Weinstock.

Ecology Law Quarterly, Vol 9, No 2, p 243-294, 1981. 1 Fig, 1 Tab, 361 Ref.

Descriptors: *Water reuse, *Legal aspects, *Water supply development, *Wastewater renovation, Public health, Water resources development, *California, Financial aspects, Torts, Liability.

Several obstacles to wastewater reclamation which may hinder expanded use of reclaimed water are discussed. Wastewater reclamation technology and the possible uses of reclaimed water are reviewed. The California State agencies that regulate water reuse and the problems they face in promoting reclamation are considered. The need to make reclaimed water cost-competitive with virgin water and the current limitations on government funding for reclamation projects are considered. Two sections on legal issues critical to water reuse in California are included. The first evaluates the impact of California water law on reclamation efforts, and the second discusses the health risks posed by water reuse and the potential application of tort liability theories to injuries caused through the use of reclaimed water. (Baker-FRC)
W83-01074

WATER REGULATIONS,
League of Nebraska Municipalities, Lincoln.
G. Wolverton.
Current Municipal Problems, Vol. 7, No. 3, p 324-326, Winter, 1981.

Descriptors: *Water use, *Regulations, *Water distribution, Water supply, Water demand, Legislation, Federal jurisdiction, Local governments, State jurisdictin, Legal aspects.

Eleven types of regulations that may affect water distribution operations have been defined, seven of which bring about federal statutory control. These are the Safe Drinking Act (SDWA), Clean Water Act (CWA), Clean Air Act (CAA), Resource Conservation and Recovery Act (RCRA), Hazardous Materials Transportation Act (HMTA), Occupational Safety and Health Act (OSHA), and the National Energy Conservation Policy Act (NECPA). The other four types of regulations are basically state and local controls and may have wide variations from place to place. These are Public Utilities Acts, Water Supply Statutes, Environmental Satutes and Water Supply Agreements. The SDWA directs the EPA to set and enforce national regulations restricting the concentrations of contaminants in the drinking water. The CWA has two sections which may impinge on use of reclaimed water and distribution systems. The CAA affects water supply operations indirectly by requiring vehicles to have proper pollution control devices. RCRA treats the disposal of sludge in water treatment plants as well as waste oil from garages and pumping plants. HMTA calls for registering and directing the transportation of hazardous materials. NECPA could become a regulator under the energy conservation regulations now being written. The Public Utilities Commissions have a broad spectrum of control over financing, rates and operation. Environmental Statutes impose their rules on water distribution systems operating under some type of federal authority. Water supply agreements usually impose regulations only on member agencies. (Baker-FRC)
W83-01144

FEDERAL COMMON LAW AND ITS APPLICATION TO DISPUTES INVOLVING ACCRETIVE AND AVULSIVE CHANGES IN THE BOUNDS OF NAVIGABLE WATERS,
Quarles and Brady, Milwaukee, WI.
J. C. Cabaniss.
Land and Water Law Review, Vol 17, No 2, p 329-365, 1982. 182 footnotes.

Descriptors: *Riparian rights, *Boundary disputes, *Water rights, *Legal aspects, *Water law, Property rights, Judicial decisions, Federal jurisdiction, State jurisdiction, Common law, Accretion, Avulsion, Navigable waters, Constitutional law, Jurisdiction, Property boundaries, Public lands, Legislation, Interstate rivers.

The choice of law rules that affect riparian rights following changes in water boundaries due to accretion or avulsion is explained. Two alternatives are federal common law and state law. The current state of the law in each area and the proper choice of law for establishing the initial boundary of a federal patent are discussed. Also addressed are the problems of riparian rights in cases of property owned prestatehood and accreted or avulsed after statehood, what federal interests are present in determining the type and scope of title acquired by public land states on admission to statehood under the equal footing doctrine, and the choice of law rule for locating an interstate boundary affected by accretion or avulsion. Several inconsistent Supreme Court decisions are discussed. It is suggested that the federal protection of riparian rights should be based on the 5th and 14th amendments, which prohibit taking property without just compensation. (Cassar-FRC)
W83-01160

GOVERNMENT ANNOUNCES POLICY ON WILD RIVERS,
D. Leather.
Soil and Water, Vol 16, No 1, p 22-23, February, 1980.

Descriptors: *Rivers, *Recreation, *Policy making, Regulations, Political aspects, Administrative decisions, Public policy, Political constraints, Legal aspects, *New Zealand.

A new policy concerning wild and scenic rivers was announced by the New Zealand government in November of 1981. The policy statement declared that rivers or sections thereof that have outstanding wild, scenic or other natural characteristics should be protected. Existing legislation will have to be strengthened with statutory provisions. Recreational users should be given the same opportunity to apply for the protection of a river as other river users have to protect their use by obtaining water rights. The Canoeing Association has been the most vociferous lobby group in the wild and scenic rivers debate thus far, and it has been the only group to comment publicly on the policy statement. (Baker-FRC)
W83-01164

THE NATIONAL DEVELOPMENT ACT AND REGIONAL WATER BOARDS,
E. J. Hudson.
Soil and Water, Vol 16, No 2, p 4-5, April, 1980.

Descriptors: *Water resources development, *Regulations, *Legal aspects, Water development, Water supply, Water quality, Political aspects, National Development Act, *New Zealand.

The National Development Act became law in New Zealand in December of 1979. The aim of the Act is to provide for prompt consideration and obtainment of statutory consents for proposed works of national importance. The effect of the Act is to increase significantly the power of the executive. The Act will have several effects on water boards. A regional water board is bound to observe the principles of the Water and Soil Conservation Act of 1967 as pertains to the conservation, allocation, use and quality of natural water; the promotion and controlling of multiple uses of natural water; and the needs of primary and secondary industry, fisheries and wildlife habitat. Another effect on regional water boards is that under the Act a board can be required to investigate an application and make a report with recommendations to the Tribunal. However, there is no provision as to who should bear the cost of such an investigation. A third major effect of the Act is the time limit imposed upon a water board for investigation of applications and recommendations pursuant to Section 6 of the Act. The 4.5 months allowed for investigation of an application and making of a report may in many cases be insufficient. In spite of its shortcomings, the Act is here to stay, and regional water boards will have to learn to work within its confines. (Baker-FRC)
W83-01167

A WATER RIGHT FOR FISHERIES,
Wellington Acclimatisation Society (New Zealand).
N. Watson.
Soil and Water, Vol 16, No 3, p 14-16, June, 1980. 1 Fig.

Descriptors: *Water rights, *Fisheries management, Water quality, Water demand, Fish, Legislation, Fisheries, *New Zealand.

The responsibility for managing New Zealand's freshwater fisheries belongs to the Acclimatisation Societies under a statutory arrangement. Management of fisheries now involves the protection of rivers and existing trout habitats from harmful developments. Thus the Wellington Acclimatisation Society applied to the Manawatu Catchment Board for a water right to use for the maintenance of a trout fishery those waters of the Manawatu Catchment District which fall in the Wellington Acclimatisation Society district. The key question in the appliation is whether the acclimatisation society is legitimately using natural water for the maintenance of a trout fishery. Indeed, in the Manawatu catchment the water is being actively used for the specific purpose of protecting, maintaining and improving the stocks of trout to provide recreation. By granting the water right to the society the Catchment Board has accepted the challenge of recognizing under the law the usage of water for sports fisheries. (Baker-FRC)
W83-01293

SUPREME COURT ISSUES GROUNDWATER RIGHTS RULING,
K. McCray.
Water Well Journal, Vol 36, No 9, p 53-54, September, 1982.

Descriptors: *Water rights, *Legal aspects, *Groundwater, Water resources development, Water supply, Supreme Court, Regulations, Nebraska, State Jurisdiction, Water supply development.

A recent ruling of the Supreme Court based on the Constitution's commerce clause jeopardizes laws in 13 Western states that ban or limit out of state groundwater resource use. Seventeen states had filed briefs supporting Nebraska's contention that states have the right to regulate internal groundwater use. The ruling still allows the states to have significant power under other provisions to control out of state water shipments. Congress may now be forced to nationally protect groundwater in the light of the Supreme Court's Nebraska ruling. The Court said that the existence of 37 statutes and several interstate compacts demonstrating Congressional deference to state water law has not granted the states permission to engage in groundwater regulation outside of existing constitutional restraints. Only where Congress' intent and policy to sustain state legislation from attack under the commerce clause is expressly stated are such restraints legal. (Baker-FRC)
W83-01337

6F. Nonstructural Alternatives

PREVENTING EROSION, LANDSLIP AND FLOODING, A PLANNING APPROACH,
Ministry of Works and Development (New Zealand).
J. Lawrence.
Soil and Water, Vol. 16, No. 1, p 19-21, February, 1980.

Descriptors: *Water resources development, *Plannng, *Erosion control, Urban planning, Drainage, Urban drainage, Reginal development, Flooding, *Australia, New South Wales.

A general awareness has arisen in New South Wales (Australia) that soil erosion and flooding can be avoided by considering physical hazards before zoning and subdivision take place for urban development. An urban capability map is derived for an area under study from an assessment of the interaction of physical features on the site. Relevant climatic data is presented, along with landlform, ge-

ology, soils and drainage information. A soil mapper then carries out a soil survey of the site, using landform boundaries to indicate soil unit changes, and confirms these with laboratory analysis of engineering properties and erodibility as well as information on soil drainage and depth to bedrock. All this information about the site is used to prepare an urban capability map, depicting a number of classes, sub-classes and a recommended capability for each class. A number of sub-classes are defined to indicate the dominate physical limitations which restrict development. As well as providing capability surveys for local councils, the Soil Conservation Service gives site-specific advice while subdivision and building activities are proceding and where problems arise in areas already developed. (Baker-FRC)
W83-01147

6G. Ecologic Impact Of Water Development

SIMULATING THE LATERAL TRANSPORT OF ICHTHYOPLANKTON IN THE POTOMAC ESTUARY,
Maryland Univ., Solomons, Center for Environmental and Estuarine Studies.
For primary bibliographic entry see Field 2L.
W83-01136

OHIWA HARBOUR, NATURAL VALUES,
Ministry of Agriculture and Fisheries Auckland (New Zealand). Fisheries Management Div.
J. Akroyd, and A. Kilner.
Soil and Water, Vol. 16, No. 2, p 18-21, April, 1980, 1 Fig.

Descriptors: *Water resources development, *Estuaries, *Environmental effects, Water quality, Harbors, Recreation, Ohiwa Harbor, *New Zealand.

Ohiwa Harbour is a shallow tidal estuary lying in the eastern Bay of Plenty (New Zealand). The surrounding country is rolling farm land, with a few areas of bush. Intertidal zones are extensive in area and gently shelved, with the greatest width occurring in the mid-tidal zone. Plant life is luxuriant and diverse, largely due to shallowness of the water, which allows light penetration, shelter and nutrient input. The harbor is close to a number of urban centers and offers opportunity for many activities. The greatest threat is the common attitutde that an estuary represents unused space to be developed. Other threats accrue indirectly from activities occurring within the watershed. Stopbanking, drainage, infilling and fencing off of parts of the estuary in attempts to increase agricultural production can have serious effects on the ecosystem. (Baker-FRC)
W83-01146

A RIVER STUDY.
For primary bibliographic entry see Field 5G.
W83-01150

THE EFFECTS OF MINING SOUTHLAND LIGNITE ON WATER AND SOIL RESOURCES,
Southland Catchment and Regional Water Board (New Zealand).
W. J. Tuckey, and L. R. McKenzie.
Soil and Water, Vol 16, No 1, p 2-6, February, 1980. 1 Fig.

Descriptors: *Environmental effects, *Mining engineering, *Water quality, Water supply, Coal mining, Water demand, Water use, Recreation demand, Agriculture, Industrial water, *New Zealand, Mataura Valley, Southland.

A proposal has been made to turn lignite coal from Southland (New Zealand) into liquid fuel. Implications of such proposals for the soil and water resources of Southland are commented upon in this article. About 85% of the available lignite in the Mataura Valley occurs in six deposits, covered by a wide range of landforms and soil types, so large-scale lignite mining would have a varied environmental effect both during and after extraction. The deposits underlie some of the most versatile soils in Southland, some of which are valuable as food production soils. A major problem is the effect of drainage both on and off site. Restoration and subsequent drainage of rolling country is not viewed as too great a problem. However, extraction from the several flat low-lying areas could be ruled out due to the lack of height of the land above sea-level and the resultant effect on the water table. A number of water users already have large claims on the available surface water and groundwater for industrial processing and waste disposal. In the southern lignite deposits, mining would be carried out below sea level, and the dewatering of opencast areas has led to concern that possible salt water intrusion might ruin existing groundwater supplies. The operation of opencast mines will have both on-site and off-site effects on water qualithy and quantity, not only for industrial but for agricultural and recreational users as well. (Baker-FRC)
W83-01151

ASWAN - DAM AND BE DAMNED.
For primary bibliographic entry see Field 4A.
W83-01156

MAHURANGI, PROBLEMS OF MANAGEMENT,
Rodney County Council (New Zealand).
M. Elliot.
Soil and Water, Vol 16, No 2, p 26-28, April, 1980. 2 Fig.

Descriptors: *Water resources development, *Environmental effects, *Water management, Mahurangi Harbor, *New Zealand, Harbors.

The Mahurangi Harbour (New Zealand) is extensively shoaled. Its intertidal foreshores tend to be wide and soft. Water quality monitoring has shown the harbor to be essentially pollution free. There are few points for public access to the harbor, and these do not lend themselves to significant expansion. Residential settlement is also limited. The catchment area of the harbor is small and contains mainly pastoral farms with some timber growing. Issues to be considered in planning for development of the Mahurangi harbor and catchment include protecting existing oyster farming industry from environmental change, preventing oyster farming from expanding to the detriment of other harbor values, and balancing recreational, aquaculture and environmental values. (Baker-FRC)
W83-01168

MANGANUI-A-TE-AO: THE TUG OF WAR RIVER.
Soil and Water, Vol 17, No 1, p 20-22, February, 1981. 1 Fig.

Descriptors: Rivers, *Water resources development, *Planning, Fisheries, Powerplants, Water quality, Regulations, Legal aspects, *New Zealand, Environment effects, Manganui-a-te-Ao River.

The Manganui-a-te-Ao River in New Zealand is becoming a test case for decision, as it is both well suited for the development of a small hydro scheme and a prime candidate for preservation in its unmodified natural state. The river and its tributaries rise on the western slopes of Mt. Ruapehu, flow through the Eura State Forest, through farmland near Raetihi and into the Waganui River above Pipiriki. Three power schemes can be conveniently located on the river using a system of dams and tunnels to obtain generating head. While the Power Board was preparing its plans, the Ministry of Environment along with the Minister of Works and Development said that the Government had approved policy that would ensure the protection of rivers or sections of rivers with outstanding wild, scenic or other natural characteristics. One possible avenue to explore is the provision in the Water and Soil Conservation Act which enables the National Authority to fix a minimum acceptable flow for any river or stream. The ultimate future of the Manganui-a-te-Ao River will be primarily affected by a judgment on whether the claim of the Power Board that both a hydro development and a fishery can co-exist can be substantiated. (Baker-FRC)
W83-01174

SOME OBSERVATIONS ON THE ECOLOGY AND FISH MANAGEMENT OF RESERVOIRS IN THE UNITED STATES,
Fish and Wildlife Service, Slidell, LA.
N. G. Benson.
Canadian Water Resources Journal, Vol 7, No 1, p 2-25, 1982. 5 Fig, 1 Tab, 30 Ref.

Descriptors: *Reservoirs, *Fisheries, *Fish management, Reservoir fisheries, Ecosystems, Ecology, Fish, Plankton, Nutrients, Fish populations, Vegetation.

In the United States by the year 1980 there were 1608 reservoirs with a surface area of 4 million ha. Due to a lack of suitable sites and the opposition of environmental interests, construction of new reservoirs has decreased in recent years. Reservoirs have characteristics of both lacustrine and riverine ecosystems. For simulation model studies reservoirs have been segmented into riverine, transitional and lacustrine zones. Fish and plankton production increases rapidly after initial impoundment and then decreases and stabilizes at lower levels. Decreases in the number of fish species and in fish biomass following impoundment are caused by reduced quantity and quality of spawning and nursery habitat and decreased detrital input. The most effective fish management programs have included introduction of new fishes, developing vegetation or building structures on the reservoir bottom. Considerable progress has been made in predicting the effects of environmental parameters on fish production. Many of the important controlling parameters are beyond the control of the fishery manager for long term management, as they were set when the reservoir was built. Future fish management at reservoirs should be directed toward developing a better understanding of those ecological factors that can be controlled after the reservoirs are constructed. (Baker-FRC)
W83-01225

PATH ANALYSIS OF A RESERVOIR ECOSYSTEM MODEL,
Georgia Univ., Athens. Inst. of Ecology.
B. C. Patten, T. H. Richardson, and M. C. Barber.
Canadian Water Resources Journal, Vol. 7, No. 1, p 252-282, 1982. 6 Tab, 9 Ref.

Descriptors: *Reservoirs, *Ecosystems, *Path analysis, Lakes, Lake Texoma, *Texas, *Oklahoma, Mathematical equations, Model studies.

A path analysis of a static ecosystem model for a cove in Lake Texoma, Texas-Oklahoma, was performed based on algebraic manipulations of the adjacency matrix and a corresponding Markov one-step transition matrix. The analysis revealed that overwhelming predominance of indirect or direct effects occurred. Very long path lengths were required to approach total effects. Self-effects of compartments diminished with increasing path lengths. Interaction effects between compartments initially increased and then decreased with increasing path length. Each compartment's structural and functional relationship within the model could be characterized in terms of numbers of incoming and outgoing paths of different lengths and influences associated and rates of change of structural and functional input-output coupling with increasing path length and whether they are net producers or consumers of influence in the system network. (Baker-FRC)
W83-01228

SIMULATION OF FISH MOVEMENTS IN A LARGE HYDRO-ELECTRIC RESERVOIR: LG-2,
Sherbrooke Univ. (Quebec). Faculte des Sciences Appliquees.
K. Morrison, and N. Therien.
Canadian Water Resources Journal, Vol. 7, No. 1, p 416-429, 1982. 7 Fig, 5 Ref.

Descriptors: *Reservoirs, *Fish, *Environmental effects, Habitats, Flooding, Model studies, Fish populations.

To examine the utilization of new habitats by fish, as would occur in reservoir flooding, a two-dimensional model was made of fish movements in the LG-2 reservoir. The model can take into account the effects of several factors on fish movements. While many researchers have studied swimming speeds in laboratories, such results are not applicable for obtaining displacement speeds in a natural system. Therefore, Monte-Carlo simulations based on fish tracking studies have been used to estimate net displacements per unit time for individual fish. This information has been used to give a time frame to the full-reservoir model. The first use of the model was to examine the dispersion of fish into the reservoir in the first year. Examinations have been done for the major species found in the area. Results are compared to catch-per-unit-effort data collected the year after flooding. The model gives relative densities of fish at grid points in the reservoir over time. The results of the model have implications as to the interpretation of fish data collected after impoundment. (Baker-FRC)
W83-01229

LIMNOLOGY OF MT. ELBERT FOREBAY 1978-79,
Bureau of Reclamation, Denver, CO. Engineering and Research Center.
For primary bibliographic entry see Field 2H.
W83-01268

THE DYING ESTUARY,
P. Gregory.
Soil and Water, Vol 17, No 2, p 18-19, April, 1981. 1 Fig.

Descriptors: *Estuaries, *Environmental effects, Water resources development, Estuarine environment, Sand, Land reclamation, Fishing, Silt, *Silting, Sedimentation, Seawater, *New Zealand, Maketu Estuary, Wetlands.

The Maketu Estuary is one of New Zealand's endangered wetlands. Sand is strangling this estuary; the mussel beds have disappeared. It is anticipated that a storm could close the outlet altogether and the sea could then overtop the low-lying sandy spit now dividing the estuary from the ocean and flood the lagoon with salt water, which would flow onto adjacent farmland. These problems began to develop in 1956, when the Kaituna River was diverted at Te Tumu to flow through 'The Cut' at the farthest end of the bar from Maketu township. The long term effects of this diversion were not carefully considered. This deversion, plus the 1974 blocking of a causway, has caused the present situation. A proposed comprehensive catchment control scheme is in the works which will cost about $20,000. Two options are being considered: First, to construct and maintain a stable outlet from the estuary to the sea, and secondly, to abandon the sea outlet, allow natural deterioration to continue, and provide for discharge of drainage of the estuary catchment into the Kaituna River. (Baker-FRC)
W83-01291

MORE OR LESS WATER,
Friends of the Earth, Nelson (New Zealand).
D. Shaw.
Soil and Water, Vol. 17, No. 2, p 20-21, April, 1981.

Descriptors: *Water supply development, *Dam construction, *Environmental effects, Floods, Earthquakes, Water quality, Nelson, *New Zealand, Waimea estuary, Estuaries, Water resources management, Earth dams.

Two aspects of water use in the Nelson City area are examined. The present water supply system is estimated to be able to supply about 22,000 cubic meters of water per day during low rainfall periods in the summer. Water usage reaches an estimated summer peak of 34,000 cubic meters per day, resulting in the need for restrictions on domestic water use. Possible schemes have been examined to augment the water supply. A 36 meter high earth-fill dam on the north branch of the Maitai River was the preferred approach. Rate-payers will be faced with considerable rate increases over the next few years to pay for the dam construction, loan servicing and the almost inevitable cost overruns. However, a study also indicated that water conservation measures aimed at making more efficient use of the water consumed at present could make a very significant impact on reducing water consumption, and perhaps the need for such a large and expensive dam would also be reduced. Various conservation measures could be encouraged, which would also reduce water usage. The poor water quality currently experienced by Nelson residents would not necessarily be improved by the dam construction. There is also a fear of significant destruction should the dam crack under earthquake or flood conditions. Another concern is for the Waimea Estuary, which will be significantly altered should dam construction proceed. (Baker-FRC)
W83-01317

CUBA'S ZAPATA PROJECT,
T. W. Saenz, and T. Lang.
Ambio, Vol 11, No 4, p 231-234, 1982. 1 Fig, 4 Tab, 4 Ref.

Descriptors: *Environmental effects, Water resources development, Swamps, *Zapata Swamp, Gulf of Batabano, Ecosystems, *Cuba.

The Zapata Project is part of a larger investigation into the ecological evaluation of the influence of use of pesticides and fertilizers on aquatic and terrestrial ecosystems. The socio-economic development of the Zapata Swamp area involves the widespread application of pesticides and fertilizers in the citrus, rice and sugar cane plantations; the generation of more industrial wastes, mainly from the sugar industry; and an increase in the consumption of surface and groundwater. The first stage of the project is to determine the amount of organic matter and other pollutants from agriculture and industry being discharged into the Swamp and through it to the Gulf of Batabano; to determine characteristics and parameters of the dominant terrestrial and aquatic ecosystems and the role they play in the Zapata Swamp/Gulf of Batabano interface; to make an integrated evaluation of the environmental impacts produced by the social and economic activity in the region; and to make recommendations for the rational use of the region's natural resources, taking into consideration the economic and social aspects involved. Finally the plan will create a technical and scientific infrastructure in the region to facilitate local research activity and provide the basis for the systematic monitoring of the different ecosystems, the environmental impact on them, and the elaboration of appropriate recommendations. (Baker-FRC)
W83-01328

THE SELECTION OF FISHERY PARAMETERS FOR INCLUSION IN THE STREAM REACH INVENTORY AND CHANNEL STABILITY INDEX,
Wyoming Univ., Laramie. Dept. of Agricultural Engineering.
W. H. Eifert.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-146696, Price codes: A06 in paper copy, A01 in microfiche. M.S. Thesis, May 1982. 122 p, 13 Fig, 15 Tab, 81 Ref, 2 Append. OWRT-A-033-WYO(2).

Descriptors: *Stream banks, *Channels, *Aquatic habitats, *Trout, Watersheds, Fish populations, Standing crops, Habitats, *SRICSI scores.

An ocular watershed evaluation methodology, entitled Stream Reach Inventory and Channel Stability Index (SRICSI), was designed primarily to assess the physical aspects of channel and streambank stability. The SRICSI's value as an aquatic habitat evaluation technique was basically unknown. During the spring and summer of 1981, seventeen representative study sites on two second-order montane streams were evaluated through application of the SRICSI procedure and three aquatic habitat assessment methodologies. Salmonid population estimates were also obtained for each site. Results indicate that a significant relationship exists between SRICSI scores and both trout population estimates, and to two of the three habitat evaluation procedures. All observed correlations were negative, suggesting that as SRICSI scores increase, trout standing crops and habitat condition decreases. Of 63 habitat-related independent variables, 40 also display significant correlation to trout standing crop data. Fifteen variables were selected for possible inclusion in the SRICSI. Inclusion of those variables found compatible with the SRICSI procedure should increase its biological sensitivity, thereby broadening its use in aquatic habitat studies. (Moore-SRC)
W83-01364

7. RESOURCES DATA

7A. Network Design

RAINFALL VARIATION ANALYSIS AND OPTIMIZATION OF GAGING SYSTEMS,
Agricultural Research and Education Center, Belle Glade, FL. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 2B.
W83-01202

A MICROPROCESSOR CONTROLLED SYSTEM FOR STORM WATER SAMPLING (EIN MIKROPROZESSOR-GESTEURTES SYSTEM ZUR PROBENNAHME AUS REGENEASSERKANALEN),
Hanover Univ. (Germany, F.R.). Inst. fuer Wasserwirtschaft, Hydrologie und Landwirtschaftlichen Wasserbau.
H-R. Verworn, and O. Paulsen.
Wasserwirtschaft, Vol 72, No 6, p 240-245, 1982. 4 Fig, 2 Ref. English summary.

Descriptors: *Meteorological data collection, *Data processing, *Rainfall, *Storm runoff, *Water sampling, Computers, Automation, Federal Republic of Germany, Gages, Rain gages, Water pollution, Data interpretation.

A microprocessor-controlled system is described that allows the synchronized collection of precipitation and runoff data as well as goal-directed water sampling in relation to these data. In this way the problems of mixed samples and an excessive collection of samples are avoided, and it is possible to analyze the relationships between pollution parameters on the one hand and regional characteristics, rainfall and runoff on the other. The system was located in Hildesheim (Federal Republic of Germany) and consisted of eight water-level gages, three of which were equipped to take samples, connected to a central processing unit (CPU). The advantages of the system were that measurements were not dependent upon a team of technicians being present during a runoff incident, measurements could be taken at several stations simultaneously, and peak runoff could also be measured. The CPU was a PSI 80-M with a 64 K byte memory, control screen, and two floppy disc drives and was equipped with two eight-channel analog/digital converter panels to convert the measurement data between 0 and 10 V into digital values. operation of the measuring system was monitored and controlled by a continuous real-time program. The program collected the data from rainfall and runoff gages, controlled the samplers, printed out announcements and data, and stored data on floppy discs. Two strategies for sampling were used. Strategy A consisted of the collection of as many rainfall-runoff incidents as possible, while strategy B called for samples of incidents with higher runoff only. For a specific incident, strategy B delivered insufficient data; the number of samples taken (7) did not accurately reflect either the pollution in the first part of the wave or the changes in the course of the incident. Strategy A resulted in the collection of 13 samples, all of which were analyzed for 5-day BOD, COD, ammonium, and chloride. Strategy B does, however, leave empty sample bottles in readiness for a

possible larger incieent occurring within a short time span. (Gish-FRC)
W83-01342

TECHNICAL MANUAL FOR GROUNDWATER EXPLORATION IN ARID AND SEMIARID REGIONS USING LANDSAT VISUAL AND DIGITAL ANALYSES,
Greenhorne and O'Mara, Inc., Riverdale, MD.
J. A. Monte, and D. I. Cooper.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-146373, Price codes: AO8 in paper copy, AO1 in microfiche. Completion Report, August 1982. 138 p, 33 Fig, 8 Tab, 40 Ref, 2 Append, plus 6 Transparent Overlays. OWRT C-10058-G(1479)(1). 14-34-0001-1479.

Descriptors: *Satellite technology, *Remote sensing, *Groundwater, *Arid lands, *Landsat, *Geohydrology, Exploration, Phreatophytes, Soil moisture, Topography, Terrain analysis, *New Mexico.

A viable addition to traditional methods of identifying exploratory ground water test well sites is the use of visual and digital Landsat remote sensing technology as an investigative technique. Areas of goundwater discharge are easily recognized from Landsat; they provide valuable clues for defining potential groundwater drilling sites. The research coupled computer-assisted digital image analysis, using an albedo transform in a time series mode, to existing visual qualitative investigative techniques of Landsat data, and investigated the value of applying non-traditionally used groundwater terrain indicators, such as phreatophytic vegetation and soil moisture to groundwater exploration. Southwestern New Mexico, with its basin and range topography, comprised the project area that was subjected to research investigations, reconnaissance and ground verification of Lansat imagery. Combined visual and digital analyses resulted in maps that specify sites recommended for drilling. For the visual Landsat analysis, an overlay system was used to interpret the geohydrology of the project area. Two primary and four secondary drilling sites were delineated on the overlay. As a result of visual analysis, groundwater suspect areas selected for potential drilling were reduced from approximately 13,000 sq mi to 40 sq mi. Digital analyses further reduced the areas to individual target sites measuring 1/3 sq mi or less. A tendency toward unusually higher well yields was observed for the target sites than for surrounding areas. (Moore-SRC)
W83-01356

AN OPERATIONAL KEY STATION NETWORK FOR THE SONE CATCHMENT,
Flood Meteorological Office, Patna (India).
K. Prasad.
Mausam, Vol 33, No 1, p 107-112, 1982. 5 Fig, 2 Tab, 2 Ref.

Descriptors: *Network design, *Gaging stations, *Rainfall, Regression analysis, Sone River, *India.

A rainfall gage network design for the Sone River catchment (a tributary of the Ganga River, India) was designed by stepwise multiple regression analysis. This 71259 sq km rectangular-shaped catchment is prone to severe and frequent flooding. Data from the 13 stations in the upper subcatchment and 18 in the lower subcatchment were used for regression analysis (1951-60) and for testing the equations (1961-70). The key station network derived from the analysis consisted of 6 stations in the upper catchment and 7 in the lower catchment. For each subcatchment an additional station was designated to replace any key station not in operation. (Cassar-FRC)
W83-01384

7B. Data Acquisition

COMPARATIVE STUDY AND CALIBRATION OF SENSORS FOR THE MEASUREMENT OF THE LIQUID WATER CONTENT OF CLOUDS WITH SMALL DROPLETS,
Clermont Univ., Aubiere (France).
P. Personne, J. L. Brenguier, J. P. Pinty, and Y. Pointin.
Journal of Applied Meteorology, Vol 21, No 2, p 189-196, February, 1982. 11 Fig, 3 Ref.

Descriptors: *Clouds, *Atmospheric water, *Measuring instruments, Particle size, Forward Scattering Spectrometer Probe, Johnson-Williams probe, Ruskin probe.

Results from three probes used to measure liquid water content of clouds were compared using data produced during the Precipitation Enhancement Project and the West African Monsoon Experiment. The probes were: the Forward Scattering Spectrometer Probe (FSSP) based on measurement of laser light intensity scattered by each droplet, the Johnson-Williams (JW) probe based on the cooling of a hot wire under constant voltage when impacted by droplets, and the Ruskin probe based on the measurement of the attenuation of Lyman alpha radiation by the water vapor obtained after evaporation of droplets and ice crystals on heated grids. There was disagreement between results from the three probes. The FSSP undercounted the droplet concentration when the mean time lapse between successive particles approached 16 microseconds. The JW underestimated the liquid water content of large droplets ($>$ 30 microns). With corrections, accuracies of the FSSP and JW were improved to produce good agreement with the Ruskin probe. (Cassar-FRC)
W83-01091

THE SELECTION OF FISHERY PARAMETERS FOR INCLUSION IN THE STREAM REACH INVENTORY AND CHANNEL STABILITY INDEX,
Wyoming Univ., Laramie. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 6G.
W83-01364

7C. Evaluation, Processing and Publication

WATER RESOURCES DATA, UTAH, WATER YEAR 1981.
Geological Survey, Salt Lake City, Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-120188, Price codes: A99 in paper copy, A01 in microfiche. Geological Survey Water-Data Report UT-81-1, 1982. 708 p, 12 Fig, 1 Tab.

Descriptors: *Hydrologic data, *Surface water, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Wells, Water level, Data collections, Sites, *Utah.

Water resources data for the 1981 water year for Utah consist of records of stage, discharge, and water quality of streams; stage and contents of lakes and reservoirs; and water levels and water quality of ground water. This report contains discharge records for 274 gaging stations, stage and contents for 19 lakes and reservoirs, water quality for 65 hydrologic stations and 375 wells, miscellaneous temperature measurements and field determinations for 181 stations, and water levels for 36 observation wells. Additional water data were collected at various sites not involved in the systematic data-collection program and are published as miscellaneous measurements. These data represent that part of the National Water Data System collected by the U.S. Geological Survey and cooperating State and Federal agencies in Utah. (USGS)
W83-01178

WATER RESOURCES DATA, VIRGINIA, WATER YEAR 1981.
Geological Survey, Richmond, VA. Water Resources Div.
Geological Survey Water-Data Report VA-81-1, 1982. 554 p, 6 Fig.

Descriptors: *Hydrologic data, *Surface water, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Wells, Water level, Data collections, Sites, *Virginia.

Water resources data for the 1981 water year for Virginia consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels and water quality of ground-water wells. This volume contains records for water discharge at 211 gaging stations, stage only at 1 gaging station, stage and contents at 10 lakes and reservoirs, water quality at 48 gaging stations and 75 wells, and water levels at 57 observation wells. Also included are data for 64 crest-stage partial-record stations. Additional water data were collected at various sites not involved in the systematic data-collection program. Discharge measurements were made at 98 coal-monitoring partial-record stations and at 171 low-flow partial-record stations. Miscellaneous data were collected at 285 measuring sites and 170 water-quality sampling sites. These data represent that part of the National Water Data System collected by the U.S. Geological Survey and cooperating State and Federal agencies in Virginia. (USGS)
W83-01179

MAP OF WATER TABLE IN SOLOMON RIVER VALLEY, WACONDA LAKE TO SOLOMON, NORTH-CENTRAL KANSAS, MAY 1980,
Geological Survey, Lawrence, KS. Water Resources Div.
T. B. Reed.
Geological Survey Open-File Report 81-334 (WRI), 1981. 1 Sheet, 4 Ref.

Descriptors: *Maps, *Water table, Contours, Wells, Water level, Groundwater, Groundwater movement, Streams, Water supply, *Kansas, Solomon River valley.

A map of the water table in the Solomon River valley from Waconda Lake to Solomon presents current (1980) data on water levels in the unconsolidated deposits. The Solomon River, which originates in western Kansas, flows southeastward from Waconda Lake to its confluence with the Smoky Hill River at Solomon. In the study area, its valley is incised into consolidated rocks that are composed mostly of shale and limestone. The unconsolidated deposits in the valley underlie the flood plain and the terrace. The alluvial deposits generally consist of gravel and sand, grading upward to sand and silt, with clay lenses interbedded throughout. Thickness of the deposits may be as much as 70 feet. Ground water in the unconsolidated deposits is a principal source of supply for domestic, stock, and irrigation use. Water-table contours indicate that ground water moves from the alluvial deposits to the stream. Thus, the Solomon River gains in flow through most of the reach. Water-level measurements for this study were made during the spring of 1980, prior to the irrigation season. (USGS)
W83-01180

MAP OF WATER TABLE IN GRAHAM COUNTY, NORTHWESTERN KANSAS, MARCH 1979,
Geological Survey, Garden City, KS. Water Resources Div.
J. M. Spinazola.
Open-File Report 81-333 (WRI), 1981. 1 sheet, 1 Ref.

Descriptors: *Maps, *Groundwater, *Water table, *Aquifers, Groundwater movement, Wells, Water level, Recharge, *Kansas, Graham County, South Fork Solomon River.

A map of the water table in Graham County provides current (1980) information on water levels in the unconsolidated deposits. Graham County has an area of 900 square miles in northwestern Kansas. The principal source of water for domestic, stock, municipal, and irrigation use if from wells in the shallow unconsolidated deposits.

The aquifers occur chiefly in the Ogallala Formation of Miocene age and in deposits of Quaternary age. Water in the aquifers generally downgradient from west to east. In the Ogallala Formation, water also moves toward the stream valleys that drain the uplands. The altitude of the water table varies seasonally in response to changes in recharge and discharge. Major sources of recharge are subsurface flow from the west, leakage from streams, and infiltration of moisture from precipitation. Discharge includes subsurface flow to the east, transpiration by plants, evaporation from the aquifer where the water table is near the land surface, flow from seeps, and pumpage from wells. The altitude of the water table is based on water-level measurements made during March 1979. (USGS)
W83-01181

PRECIPITATION DATA FOR BURIAL GROUNDS 5 AND 6, OAK RIDGE NATIONAL LABORATORY, TENNESSEE, 1976-1980,
Geological Survey, Knoxville, TN. Water Resources Div.
D. A. Webster, J. S. Beatty, P. M. Benjamin, and W. M. Tranum.
Available from OFSS, USGS Box 25425 Fed. Ctr. Denver, CO 80225. Paper Copy $2.25, Microfiche $3.50. Geological Survey Open-File Report 82-254, 1982. 15 p, 1 Fig, 3 Tab.

Descriptors: *Data collections, *Precipitation, Recharge, Groundwater reservoirs, Water level, Wells, Solid waste disposal, Rain gages, Sites, *Tennessee, Oak Ridge National Laboratory, Burial grounds.

As part of a hydrogeologic investigation, precipitation data were collected at two stations, one each in Burial Grounds 5 and 6 at the Oak Ridge National Laboratory, Tennessee. Daily, monthly, and annual values are reported herein for the period from January 1976 through December 1980. During this period, annual values ranged from about 25 percent above to about 25 percent below the calculated mean of 51.96 inches at Burial Ground 5 and 49.60 inches at Burial Ground 6. (USGS)
W83-01183

WATER-TABLE MAP OF THE SAN JOSE WELL FIELD AND VICINITY, ALBUQUERQUE, NEW MEXICO, SPRING 1981,
Geological Survey, Albuquerque, NM. Water Resources Div.
J. D. Hudson.
Available from OFSS, USGS, Box 25425, Fed. Ctr. Paper copy $1.50, Microfiche $4.00. Geological Survey Open-File Report 82-375, 1982. 4 p, 1 Tab, 1 Ref.

Descriptors: *Water table, *Groundwater, *Water quality, *Groundwater movement, Contours, Water level, Test wells, Water sampling, *New Mexico, Albuquerque, San Jose well field, Rio Grande.

Water samples taken from Albuquerque's San Jose well field during 1980 contained several undesireable organic compounds. An investigation defined the configuration of the water table in the vicinity of these wells. This map shows the direction of ground-water movement and in selecting test wells for water-quality sampling. (USGS)
W83-01184

GROUND-WATER QUALITY AND DATA ON WELLS AND SPRINGS IN PENNSYLVANIA, VOLUME III--DELAWARE RIVER BASIN,
Geological Survey, Harrisburg, PA. Water Resources Div.
H. E. Koester, and D. R. Miller.
OFSS USGS. Box 25425 Fed. Ctr. Denver, CO 80225. Paper copy $14.75, Microfiche $3.50. Geological Survey Open-File Report 81-330, March, 1982. 111 p, 9 Fig, 9 Tab, 2 Ref.

Descriptors: *Groundwater, *Water quality, *Hydrologic data, Wells, Well data, Springs, Aquifers, Water level, Elevation, Water yield, Geohydrologic units, Sites, Chemical analysis, Trace elements, *Pennsylvania, Delaware River basin.

Volume III of the Ground-Water Quality and Data on Wells and Springs in Pennsylvania presents ground-water quality and physical data on about 1,250 wells and springs in the Delaware River basin in Pennsylvania. Locations are shown on site-location maps derived from the hydrologic unit map. Codes showing the geologic age and aquifer are provided. (USGS)
W83-01185

GROUND-WATER QUALITY AND DATA ON WELLS AND SPRINGS IN PENNSYLVANIA, VOLUME II--SUSQUEHANNA AND POTOMAC RIVER BASINS,
Geological Survey, Harrisburg, PA. Water Resources Div.
H. E. Koester, and D. R. Miller.
Available from OFSS, USGS. Box 25425, Fed. Ctr. Denver, CO 80225. Paper copy $17.25, Microfiche $3.50. Geological Survey Open-File Report 81-329, March, 1982. 131 p, 16 Fig, 16 Tab, 2 Ref.

Descriptors: *Groundwater, *Water quality, *Hydrologic data, Wells, WEll data, Springs, Aquifers, Water level, Elevation, Water yield, Geohydrologic units, Sites, chemical analysis, Trace elements, *Pennsylvania, Susquehanna River basin, Potomac River basin.

Volume II of the Ground-Water Quality and Data on Wells and Springs in Pennsylvania presents ground-water quality and physical data on about 1,400 wells and springs in the Susquehanna and Potomac River basins in Pennsylvania. Locations are shown on site-location maps derived from the hydrologic unit map. Codes showing the geologic age and aquifer are provided. (USGS)
W83-01186

HYDROLOGIC MAPS OF THE OGALLALA AQUIFER, WEST-CENTRAL KANSAS, 1979-81,
Geological Survey, Garden City, KS. Water Resources Div.
J. M. Spinazola.
Available from OFSS, USGS. BOX 25425, Denver, CO 80225. Paper copy $18.00, Microfiche $2.00. Geological Survey Open-File Report 82-258, 1982. 4 Sheets, 5 Ref.

Descriptors: *Approximation method, *Hydrologic data, *Maps, *Mathematical models, *Water management, Water distribution, Groundwater, Aquifers, Water table, Irrigation, *Kansas, Ogallala aquifer, Kriging technique, Western Kansas Groundwater Management District No. 1.

A mathematical technique, called kriging, was programmed for a computer to interpolate hydrologic data based on a network of measured values in west-central Kansas. The computer program generated estimated values at the center of each 1-mile section in the Western Kansas Groundwater Management District No. 1 and facilitated contouring of selected hydrologic data that are needed in the effective management of ground water for irrigation. The kriging technique produced various maps that illustrated hydrologic conditions in the Ogallala aquifer, the principal source of water in west-central Kansas. Maps of the aquifer, which use a 3-year average, included the 1979-81 water-table altitudes, which ranged from about 2,580 to 3,720 feet; the 1979-81 saturated thicknesses, which ranged from about 0 to 250 feet; and the percentage changes in saturated thickness from 1950 to 1979-81, which ranged from about a 40-percent increase to a 100-percent decrease. A map showing errors of estimate also was provided as a measure of reliability for the 1979-81 water-table altitudes. Errors of estimate ranged from 2 to 24 feet. (USGS)
W83-01188

WATER-QUALITY AND HYDROGEOLOGIC DATA FOR THREE PHOSPHATE INDUSTRY WASTE-DISPOSAL SITES IN CENTRAL FLORIDA, 1979-80,
Geological Survey, Tallahassee, FL. Water Resources Div.
R. L. Miller, and H. Sutcliffe Jr.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-229675, Price codes: A05 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 81-84, 1982. 77 p, 30 Fig, 28 Tab, 3 Ref.

Descriptors: *Water quality, *Phosphates, *Waste disposal, *Water pollution, *On-site data collections, Chemical wastes, Surface waters, Chemical properties, Physical properties, Water sampling, Sites, Lithologic logs, Radiochemical analysis, Metals, Industrial plants, Industrial wastes, Nitrogen compounds, Organic compounds, *Florida.

This report is a complilation of geologic, hydrologic, and water-quality data and information on test holes collected in the vicinity of gypsum stack complexes at two phosphate chemical plants and one phosphatic clayey waste disposal pond at a phosphate mine and beneficiation plant in central Florida. The data were collected from September 1979 to October 1980 at thee AMAX Phosphate, Inc., chemical plant, Piney Point; the USS Agri-Chemicals chemical plant, Bartow; and the International Minerals and Chemical Corporation Clear Springs mine, Bartow. Approximmmtely 5,400 field and laboratory water-quality determinations on water samples were collected from about 78 test holes and 31 surface-water, rainfall, and other sampling sites at phosphate industry beneficiation and chemical plant waste-disposal operations. Maps show locations of sampling sites. (USGS)
W83-01190

WATER RESOURCES DATA, MINNESOTA, WATER YEAR 1981. VOLUME 2. UPPER MISSISSIPPI AND MISSOURI RIVER BASINS.
Geological Survey, St. Paul, MN. Water Resources Div.
Geological Survey Water-Data Report MN-81-2, 1982. 486 p, 10 fig, 1 Tab.

Descriptors: *Hydrologic data, *Surface water, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Wells, Water level, Data collections, Sites, *Minnesota, *Upper Mississippi River basin, *Missouri River Basin.

Water resources data for the 1981 water year for Minnesota consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels and water quality in wells and springs. This volume contains discharge records for 70 gaging stations; stage and contents for 8 lakes and reservoirs; water quality for 41 stream stations, 3 partial-record stream stations, 4 partial-record lake stations, and 98 wells; and water levels for 287 observation wells. Also included are 109 high-flow partial-record stations and 27 low-flow partial-record stations. Additional water data were collected at various sites, not part of the systematic data-collection program, and are published as miscellaneous measurements. These data, together with the data in Volume 1, represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in Minnesota. (USGS)
W83-01397

WATER RESOURCES DATA, MINNESOTA, WATER YEAR 1981. VOLUME 1. GREAT LAKES AND SOURIS-RED-RAINY RIVER BASINS.
Geological Survey, St. Paul, MN. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-131979, Price codes: A11 in paper copy, A01 in microfiche. Geological Survey Water-Data Report MN-81-1, 1982. 222 p, 9 Fig.

Descriptors: *Hydrologic data, *Surface water, *Groundwater, *Water quality, Gaging stations, Stream-flow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical anal-

ysis, Lakes, Reservoirs, Wells, Water level, Data collections, Sites, *Minnesota, *Great Lakes River basin, *Souris-Red-Rainy River basin.

Water resources data for the 1981 water year for Minnesota consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels and water quality in wells and springs. This volume contains discharge records for 47 gaging stations; stage-only records for 1 gaging station; stage and contents for 5 lakes and reservoirs; water quality for 9 gaging stations, 1 stage station, 14 partial-record lake stations, and 21 wells; and water levels for 56 observation wells. Also included are 53 high-flow partial-record stations and 1 low-flow partial-record station. Additional water data were collected at various sites, not part of the systematic data-collection program and are published as miscellaneous measurements. These data, together with the data in Volume 2, represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in Minnesota. (USGS)
W83-01398

WATER RESOURCES DATA, ILLINOIS, WATER YEAR 1981. VOLUME 2. ILLINOIS RIVER BASIN.
Geological Survey, Urbana, IL. Water Resources Div.
Geological Survey Water-Data Report IL-81-2, 1982. 538 p, 4 Fig.

Descriptors: *Hydrologic data, *Surface water, *Groundwater, *Water quality, Gaging stations, Stream-flow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Wells, Water level, Data collections, Sites, *Illinois, *Illinois River basin.

Water resources data for the 1981 water year for Illinois consist of records of stage, discharge, and water quality of streams; stage and contents of lakes and reservoirs; and water levels and water quality of ground-water wells. This volume contains records for water discharge at 82 gaging stations, stage only at 2 gaging stations, stage only at 3 lake stations, water quality at 96 gaging stations and 10 wells, and water levels at 3 observation wells. Also included are data for 18 crest-stage partial-record stations. Additional water data were collected at various sites not involved in the systematic data-collection program and are published as miscellaneous measurements and analyses. These data together with the data in Volume 1 represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State, local, and Federal agencies in Illinois. (USGS)
W83-01399

WATER RESOURCES DATA, ILLINOIS, WATER YEAR 1981. VOLUME 1. ILLINOIS EXCEPT ILLINOIS RIVER BASIN.
Geological Survey, Urbana, IL. Water Resources Div.
Geological Survey Water-Data Report IL-81-1, 1982. 673 p, 4 Fig.

Descriptors: *Hydrologic data, *Surface water, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Wells, Water level, Data collections, Sites, *Illinois.

Water resources data for the 1981 water year for Illinois consist of records of stage, discharge, and water quality of streams; stage and contents of lakes and reservoirs; and water levels and water quality of ground-water wells. This volume contains records for water discharge at 94 gaging stations, stage only 17 gaging stations, stage and contents at 3 lakes and reservoirs, stage only at 1 lake station, and water quality at 121 gaging stations and 26 wells. Also included are data for 13 crest-stage partial-record stations and 22 low-flow partial-record stations. Additional water data were collected at various sites not involved in the systematic data-collection program and are published as miscellaneous measurements and analyses. These data together with the data in Volume 2 represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State, local, and Federal agencies in Illinois. (USGS)
W83-01400

8. ENGINEERING WORKS

8A. Structures

IT'S ALL DOWNHILL FROM HERE. THE EREWHON RURAL WATER SUPPLY SCHEME,
G. James.
Soil and Water, Vol 17, No 2, p 10-16, April, 1981. 1 Tab.

Descriptors: *Irrigation engineering, *Gravity flow, *Water supply development, *New Zealand, Irrigation design, Engineering, Irrigation, Water demand, Water supply.

The development of a water supply scheme in Erewhon Riding (New Zealand) is described. The scheme is a completely gravitational one, bringing water of excellent quality to 27 farms with an area of 18,650 hectares. The source of supply, the Reporoa Bog catchment, lies at 1110 meters elevation in the north-western Ruahine Ranges. The intake was constructed at an elevation of 1105 meters in the plateau area just above the rimrock. Stage I is the linkage pipeline from the intake, across the Rangitikei River and into the main distribution area. Stage II pipeline branches off from the Stage I line 3 km below the intake and supplies the two stations on the eastern side of the river. Stage III is the reticulation throughout the main distribution areas of Pukeokahu and Pungatawa. Stage IV services two large farms in the more northerly Makokomiko area. Stage I is the key to the entire scheme, carrying water from the remote intake site across difficult terrain to a point from which the bulk of the scheme's participants can be supplied. One of the most difficult engineering feats in the scheme was the construction of the crossing of the Rangitikei Gorge. Engineers have used the inverted siphon technique. The water plummets in the pipes 585 meters down the side of the Gorge to the River below. On the way down it builds up a massive 600 pounds per square inch of pressure. Having reached the bottom, the water crosses the Rangitikei River and, still boiling through the pipe, rushes 300 meters up the other side to spill over the top and continue to the farmland it will irrigate. The pressure in the pipe is extremely important and thus is automatically monitored. The total cost of the scheme was $1,562,600, a unit cost of $83.78 per hectare. (Baker-FRC)
W83-01170

KURPSAI HYDROELECTRIC STATION ON THE NARYN RIVER,
P. Yu Kornev.
Hydrotechnical Construction, Vol. 15, No. 11, p 652-659, 1981-1982. 4 Fig, 4 Ref. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 11, p 8-13, November, 1981.

Descriptors: *Dam construction, *Dam design, *Dam foundations, *Concrete dams, *Gravity dams, *Concrete construction, *Hydroelectric plants, Dams, Concrete technology, Materials engineering, Concrete mixes, Naryn River, Kirgiz SSR, *USSR.

The design and construction of the Kurpsai hydroelectric station which was built to cover loads and provide a reserve in the interconnected power system of Central Asia are described. The main structures of the hydrostation are a gravity dam on the Naryn River, a spillway, and the powerhouse complex. The composition of the structures was closely in line with those used in sequence-type construction on mountain rivers. Use of sequence-type construction greatly shortened the preparatory period and volume of preparatory works. The penstocks of the dam were extended beyond the dam profile to its downstream face, allowing simpler construction of the seals of the contraction joints while the network of drainage galleries is distributed over the height of the dam. The Toktugal method also allows the zonal distribution of concrete so that material is used economically in the Kurpsai dam. Concreting was simplified due to elimination of pipe cooling of the dam, use of a practically uncooled concrete mix, automation of the compaction of the concrete mix, and elimination of the removal of the laitance from the horizontal joints in the internal zone of the dam. (Geiger-FRC)
W83-01234

MORE WATER FOR TEXAS COASTAL PLAINS.
Public Works, Vol 113, No 9, p 87-88, September, 1982.

Descriptors: *Reservoirs, *Pipelines, Water supply, Multipurpose projects, Palmetto Bend Project, Point Comfort, *Texas, Industrial water.

The multipurpose Palmetto Bend (Texas) Dam Project, designed to supply water to the Point Comfort region on the Gulf Coast, was recently completed. It includes the Palmetto Bend Dam across the Navidad River, the 11,000 acre Lake Texana reservoir, pumping station, a mile of surface level 30 inch steel pipe, and 13 miles of underground water transmission line. The steel pipe was lined with a 3/8 inch cement coating to minimize corrosion and water discoloration. Initially the reservoir will produce 20,000 acre ft of water to industries and 40,000 residents of the area, in which groundwater supplies have been depleted by overpumping of aquifers. (Cassar-FRC)
W83-01333

8B. Hydraulics

TENSOR STRUCTURE OF THE COEFFICIENT OF HYDRAULIC FRICTION,
All-Union Designing, Surveying and Scientific Research Inst., Moscow (USSR).
V. M. Lyatkher, and S. Ya. Shkol'nikov.
Water Resources, Vol 8, No 5, p 493-497, September-October, 1981. 10 Ref. Translated from Vodnye Resursy, No 5, p 58-62, September-October, 1981.

Descriptors: *Mathematical studies, *Flow velocity, *Shear stress, *Hydraulic friction, *Roughness coefficient, *Shallow water, Mathematical equations, Flow friction, Hydraulics, Flow pattern, Mathematical models, Model studies, Plane flow.

In open water bodies whose proposed dimensions are greater than the depth, flows are described by equations of the shallow-water theory or the planar problem. The tensor character of the coefficient of hydraulic friction in planar problems of hydraulic resistance was represented in situations of flow in the bottom layer in the presence of a laminar boundary layer, in the absence of a laminar boundary layer, in the presence of roughness of the bottom with a scalar structure, and in the presence of roughness of the bottom with a tensor structure. In the first two cases, the shear stress can be considered collinear with the bottom velocity measured at the level of the boundary of the laminar boundary layer or at the level of the characteristic projection of roughness. In the last case, the shear stress and bottom velocity are non-collinear. Two-dimensional equations of shallow-water theory were used to show the need to take into account the noncollinearity of the friction vector on the boundary of the flow and the characteristic velocity vector in terms of which this friction is expressed. A similar need arises when formulating the boundary conditions on a very rough bottom when solving three-dimensional equations of flow. (Geiger-FRC)
W83-01096

LABORATORY INVESTIGATIONS OF METHODS OF PROTECTING SUPPORTS FROM LOCAL SCOUR,

Moscow State Univ. (USSR). Hydrophysical Lab.
V. P. Gailevich, N. A. Mikhailova, N. B. Mulyukova, K. D. Savin , and P. M. Stepunin.
Water Resources, Vol 8, No 5, p 553-557, September-October, 1981. 6 Fig, 3 Ref. Translated from Vodnye Resursy, No 5, p 135-141, September-October, 1981.

Descriptors: *Scour, *Abrasion, *Channel scour, *Bridge design, *Mathematical studies, *Erosion control, *Flow velocity, Bridge construction, Bridges, Structural engineering, Channel flow, Erosion, Deformation, Bottom sediments, Graphical methods.

The characteristics of a local scour near a support in the case of forward motion of a flow as applied to a channel flow and longshore movement were studied at a 0.065 meter diameter cylinder, and two cylinders each with a diameter of 0.055 meters were used in the deformation experiments. Results showed that the depth of the scour hole increases with time up to a certain limiting value for a fixed value of the flow velocity. At a flow velocity less than the eroding velocity amarked increase of this limiting value was observed with increase of velocity. At a velocity greater than the eroding velocity, this relationship is much less pronounced. With increase of flow velocity, the area of the local scour increases substantially, especially in the rear part of the scour hole. Various blocks of tetrahedra or tetrapod shapes served as tough fillers of the scour hole and acted as a protection from scouring. Flexible contact blankets (carpets of slabs with cloth along the perimeter) protected the supports from undercutting and prevented the removal of sediments from the bottom surface near the support. Protection of supports by carpets without cloth was not as effective as protection by carpets with cloth. (Geiger-FRC)
W83-01098

THE EFFECT OF ASPECT RATIO ON LONGITUDINAL DIFFUSIVITY IN RECTANGULAR CHANNELS,
Liverpool Univ. (England). Dept. of Applied Mathematics and Theoretical Physics.
P. C. Chatwin, and P. J. Sullivan.
Journal of fluid Mechanics, Vol 120, p 347-358, July, 1982. 4 Fig, 1 Tab, 25 Ref.

Descriptors: *Channel flow, *Turbulent Flow, *Flow characteristics, Laminar flow, Aspect ratio, Diffusivity.

The value of Taylor's longitudinal diffusivity (D) for laminar flow in a channel of rectangular cross section of the dimensions a (width) and b (Height) is about 8Do for large values of the aspect ratio, a/b, when Do is the value of the longitudinal diffusivity obtained by ignoring all variation across the channel. This surprising result was originally obtained by Doshi et al. (1978). This paper considers the value of D in turbulent flow in a flat-bottomed channel of large aspect ratio, for which a formula for D is supported. The result is consistent with previous laboratory experiments by Fischer (1966). (Cassar-FRC)
W83-01115

NEW DATA ON SHAPE EFFECTS IN SMOOTH RECTANGULAR CHANNELS,
Queensland Univ., Brisbane (Australia). Dept. of Civil Engineering.
A. K. Kazemipour, and C. J. Apelt.
Journal of Hydraulic Research, Vol 20, No 3, p 225-233, 1982. 4 Fig, 4 Ref.

Descriptors: *Channel flow, *Channel morphology, *Flow resistance, *Cross-sections, Open-channel flow, Reynolds number, Friction, Shape effects.

This paper reports new experimental data as an addendum to previous work on a method for dealing with the effects of cross-sectional shape on flow resistance in open channels. The method used for measuring the normal depth of flow was refined to overcome several problems. Data showed that the variation of friction factor with Reynolds number of the channel was larger than that for a smooth pipe at the same Reynolds number value. A shape factor established a simple correlation between the flow in circular pipes and open channels and permitted the friction factor and average velocity of the flow in the channel to be calculated from the universal resistance formulas and diagrams for circular pipes. (Cassar-FRC)
W83-01221

DIRECT SOLUTION FOR UNIFORM FLOWS IN ELLIPTICAL CHANNELS,
Changchun Geology Coll. (China). Dept. of Hydrologic Geology and Engineering Geology.
Y-Z. Zhang.
International Water Power and Dam Construction, Vol 34, No 8, p 20-21, August, 1982. 2 Fig.

Descriptors: *Channels, *Design criteria, *Flow characteristics, Flow, Mathematical equations, Model studies, *Uniform flow.

A method is presented with which the problems encountered in calculating the uniform flows passing an elliptical channel can be computed easily. Uniform flow means that the flow has a constant depth; thus it may be said to be at constant speed. The channel may have several different shapes. However, the elliptical section is widely used. Applying Manning's formula to an elliptical section and appropriately modifying the coordinate equations yields two equations for the channel flow times Manning's roughness coefficient divided by fractional powers of the bed slope and the semi-minor axis of the ellipse. A series of curves can be plotted based on these equations, forming a nomograph useful in solving problems of the type. (Baker-FRC)
W83-01284

PREDICTING CAVITATION IN TUNNEL SPILLWAYS,
Bureau of Reclamation, Denver, CO.
H. T. Falvey.
International Water Power and Dam Construction, Vol 34, No 8, p 13-15, August, 1982. 4 Fig, 6 Ref.

Descriptors: *Cavitation, *Spillways, *Prediction, Mathematical equations, Fluid mechanics, Flow, Tunnels, Tunnel hydraulics, Hydraulics.

A method of calculating the location of cavitation damage in spillways is presented. The method, together with experience curves, allows damage to be estimated as a function of duration of operation. Procedures are given to design aeration grooves which can protect spillways from cavitation damage. Although the results of the study were derived primarily from tunnel spillway experience, preliminary investigations indicate that the curves are also applicable to chutes. More field experience is needed to better define the shape of the damage curve. (Baker-FRC)
W83-01285

CHARACTERISTICS OF A LOW-HEAD PRESSURE CONDUIT,
Ministry of Energy, Sofia (Bulgaria).
S. Iliev, and L. Kalchev.
International Water Power and Dam Construction, Vol 34, No 8, p 28-31, August, 1982. 2 Fig, 1 Ref.

Descriptors: Model studies, *Conduits, *Pressure head, *Pressure conduits, Pressure distribution, Reservoirs, Ponds, Surges, Surge tanks, Flow characteristics, Hydrodynamics, Fluid mechanics.

Hydrodynamic models of a low-head pressure conduit between a reservoir and its headpond have been developed. A slowly changing movement of water in the conduit and pond is considered. The latter may operate on a daily or weekly cycle, or alternatively, it may be considered as a surge chamber. The following assumptions are made in considering this model. First, the flow is uni-dimensional, making it possible to use average velocities in the cross-sections. Secondly, the pipe walls do not deform, and thus the cross-sectional area depends only on the site and is not a function of time. Third, the water does not contract, and thus the flow in the conduit depends only on time and is not a function of the site. Fourth, the water surface area in the headpond changes linearly depending on the water level, as was postulated in a previous article. The method allows accurate complex hydrodynamic studies to be made of the elements of the system for scientific purposes and for solving the technical and economic problems of design, construction and operation. (Baker-FRC)
W83-01286

EROSION OF JETS WITH CAVITATION INDUCERS,
Department of Science and Technology, New Delhi (India).
K. S. Janakiram, and B. C. Syamala Rao.
International Water Power and Dam Construction, Vol 34, No 8, p 32-36, August, 1982. 12 Fig, 15 Ref.

Descriptors: *Erosion, *Cavitation, *Jets, Water velocity, Flow velocity, Corrosion, Metals, Aluminum, Fluid mechanics, Flow characteristics.

Detailed experiments are described which were carried out to study the erosion of aluminum by the impingement of jets in which cavitation is induced. The dependence of erosion on stand-off distance and jet velocity is investigated, and the flow characteristics of jets with varying cavitation numbers are also discussed. It was concluded that the normalized erosion rate increases initially, attains a peak, and then decreases with an increase in stand-off distance. The cavity patterns obtained for cavitating jets are similar to those reported in cavitation studies. The length and width of the aavity increased with a decrease in the cavitation number. The increase is rapid at small cavitation numbers and slow at large cavitation numbers. The variation of volume loss with net velocity may be expressed by a power relationship. That is, erosion varies with the fourth to ninth power. With an increase in cavitation number the normalized erosion rate first decreases rapidly and then becomes almost constant. The normalized erosion rate increases with an increase in the frequency of impingement, and the dimensional quantity of volume loss varies with the fourth to ninth power of frequency. (Baker-FRC)
W83-01287

DYNAMIC EQUATIONS FOR STEADY SPATIALLY VARIED OPEN CHANNEL FLOW: A CRITICAL REVIEW,
Sri Venkateswara Univ., Tirupati (India). Coll. of Engineering.
P. Venkataraman, M. S. Nasser, and A. S. Ramamurthy.
Advances in Water Resources, Vol 5, No 2, p 66-72, June, 1982. 4 Fig, 1 Tab, 36 Ref.

Descriptors: *Mathematical equations, *Open-channel flow, Flow, Mathematical studies, Dynamics, *Reviews, Spatial distribution.

A review of the dynamic equations governing steady spatially varied flow in open channels is presented. The equations are derived by employing either the momentum or the energy principle: the choice of the method employed is based on convenience. Nevertheless, the two approaches yield different results when applied to a particular flow situation. Recent researches have established that this anomaly is due to the omission of the influence of the lateral flow. The inconsistencies existing among the different forms of these equations and the rather incomplete nature of their derivation are discussed. It is believed that with the present state of knowledge, it is possible to obtain identical spatially varied flow profiles when the influencing parameters are properly evaluated, whether one uses the momentum or the energy approach. The need for further study to provide a better understanding of this practically important phenomenon is established, and potential research directions are defined. Recent contributions to the analysis of the hydraulic characteristics of the spatially varied flow phenomenon and the delineation of the spatially varied flow profiles into eight possible patterns are also presented. (Baker-FRC)
W83-01395

8C. Hydraulic Machinery

MODIFIED GRAPHICAL DETERMINATION OF SUBMAIN SIZE,
Pennsylvania State Univ., University Park. Dept. of Agricultural Engineering.
W. R. DeTar.
Transactions of the ASAE, Vol 25, No 3, p 695-696, May/June, 1982. 1 Tab, 9 Ref.

Descriptors: *Pipes, *Graphical analysis, Pipelines, Water mains, Conveyance structures, Irrigation, Water transport, *Graphical methods, Mathematical studies, Irrigation design.

A simplified method for obtaining multipliers for a variety of pipe types and for any number of outlets is presented. The procedure involves the use of the correction factor commonly used in sprinkler lateral design. A table of three correction factors is given. The correction factor as used in the design of untapered sprinkler laterals can be used in the graphical determination of the proper tapering of submains in solid-set systems on non-uniform slopes. Use of this correction factor represents a considerable improvement in the technique presented in DeTar. With this improvement it becomes possible to determine the pressure distribution in perforated trickle laterals that descend slopes of any kind, and thus find the proper limit on lateral lengths. (Baker-FRC)
W83-01101

AXIAL FLOW-INDUCED VIBRATIONS IN LARGE HIGH-HEAD MACHINES,
Laval Univ. (Quebec). Dept. of Mechanical Engineering.
H. Netsch, and A. Giacometti.
International Water Power and Dam Construction, Vol. 34, No. 8, p 21-27, August, 1982. 13 Fig, 8 Ref.

Descriptors: Construction, *Hydraulic machinery, *Vibrations, *Hydraulic equipment, Flow velocity, Water velocity, Design criteria.

Construction requirements for the increasingly larger hydraulic machines coming into use, designed to operate under rather high heads and associated high water velocities, may be the cause of new vibration problems. Such problems, causes and remedial measures are considered in this article. Several choices are available to limit the impact of the wake of the spiral case tongue upon passage of the leading edges of the runner blades. For example, for large, high-head Francis turbines, the energy level of the water flows on both sides of the tongue wall could be equalized by several connecting holes. Alternatively, a connecting pipe could be located a little upstream of the tongue trailing edge and run between the incoming flow in the spiral case and the residual flow at the end of the water travel inside the spiral case. At times when the amplitude of the vibrations exceeds a safe level, attempts must be made to alter the head cover geometry by bolting or welding on stiffening elements or rings to shift the critical frequency of the cover toward a resonance-free level. (Baker-FRC)
W83-01311

SOME DESIGN FACTORS FOR THE BATH COUNTY TRASHRACKS,
Harza Engineering Co., Chicago, IL.
W. S. Hamilton, and J. P. Tullis.
International Water Power and Dam Construction, Vol. 34, No. 8, p 16-19, August, 1982. 5 Fig.

Descriptors: *Design criteria, *Trashracks, Flow pattern, Flow, Flow velocity, Turbines, Hydraulic engineering, Construction, Pumps, Virginia.

When a Bath County pump-turbine is generating power it discharges water into the lower reservoir through a conventional two-bay elbow draft tube. To protect the machine when it is pumping, trashrack panels span each bay downstream from the draft tube exit. They are located 24.4 m from the turbine centerline and 7.6 m downstream from the draft tube exit. Each machine may discharge as much as 153 cu m/second through a two-bay area at the draft tube exit of about 50 sq m. Because nearly all of the flow may travel through one bay instead of two, and because the velocity distribution in that single passage may be severely nonuniform, one may anticipate a local velocity as high as 9 to 12 m/s at the racks. Water velocity measurements were made at the draft tube exits of the pumped-storage project model and indicated that the outflow was very badly distributed. Potentially damaging high-frequency pulsations occurred as well. The way in which these conditions were measured, analyzed and scaled-up for the design of the trashracks is described. (Baker-FRC)
W83-01312

ADVANCES IN WATER AND WASTEWATER VALVES.
Consulting Engineer (St. Joseph), Vol 59, No 3, P 105-109, September, 1982. 6 Fig.

Descriptors: *Valves, *Wastewater treatment, *Water treatment, Equipment design, Gate valves, Butterfly valves, Plug valves, Ball valves, Check valves, Actuators, Hydraulic equipment, Hydraulic valves.

One of the most commonly used valves is the metal-seated double-disc gate valve. Flow shutoff is good, particularly at higher pressures. Gate valves are not recommended for precise flow control nor for continuous operation in the throttled position. One advantage of these valves is ease of maintenance. Leakage problems which limited application of the gate valve have been largely overcome by redesign of the valve itself and by the use of various synthetic coatings. Constant improvement has been noted over the past 10 years in the butterfly valve. Improvements are also noted in plug and ball valves and the check valve. Valve actuators have also undergone much study, with resulting advancements being made in this area as well. (Baker-FRC)
W83-01340

8D. Soil Mechanics

MEASURING STATION TO DETERMINE PORE WATER PRESSURE - ZERVREILA ARCH DAM (MESSANLAGE FUR PORENWASSERDUCK - BOGENSTAUMAUER ZERVREILA),
Solexperts A.G., Zurich (Switzerland).
For primary bibliographic entry see Field 8G.
W83-01100

DAM KLEINE KINZIG - DESIGN AND CONSTRUCTION (TALSPERRE KLEINE KINZIG - ENTWURF UND AUSFUHRUNG),
Ingenieurbouro, Munich (Germany, F.R.).
A. Eppler.
Wasserwirtschaft, Vol 71, No 12, p 349-353, December, 1981. 5 Fig, 3 Ref. English summary.

Descriptors: *Rockfill dams, *Dam design, *Dam construction, *Potable water, *Geology, Design criteria, Construction, *Federal Republic of Germany, Kleine Kinzig dam, Hydraulic engineering, Granites, Crystalline rocks, Asphaltic concrete, Grouting, Bedrock, Flood protection, Outlet tower, Outlet channels, Sandstones, Sedimentary rocks.

The construction of the Kleine Kinzig dam was considered necessary to ensure an adequate supply of drinking water for the central Black Forest (Federal Republic of Germany), where although rainfall is quite high, little natural water storage occurs for geological reasons. Topology and geology at the dam site are favorable. The mountains are composed of red sandstone resting on granite, and the border between old and new red sandstones is approximately at the ideal water level of the reservoir. The old red sandstone forms a natural sealing layer under the reservoir. The dam will be 74 m high, and the crown road will be 340 m long and 8 m wide. It is a rock-fill dam with an asphaltic concrete impervious core and requires 1.4 million cu m of fill material, half of which as been put into place. The impervious core, 65 m thick and inclining to the downstream side for the top 16 m, is connected to the bedrock compression by a control tunnel that is also connected to the valley sides so that these help bear the brunt of forces created in the dam. An access tunnel provides entrance to the control tunnel. The upstream half of the dam is filled with granite with an outer layer of syenite to provide drainage, while the downstream part consists of an inner zone of material from the valley walls with an outer covering of granite and a surface filter under the outer half of this section. The inner zone is only slightly permeable, and while it is being filled leaks are repaired and rock fissures plugged. Facilities for the determination of deformation, seepage, and leaks in and around the grout curtain are being installed. An outlet tower with two extraction conduits has been constructed to extract water from the reservoir. For the purpose of flood protection, a 16-m diameter inlet tulip will be constructed that will connect with the stilling basin. It will be able to divert 113 cu m/sec of water. (Gish-FRC)
W83-01110

THE RECONSTRUCTION OF THE SCHLICHEM BARRAGE NEAR SCHOMBERG IN THE ZOLLERNALB DISTRICT (DIE SANIERUNG DER SCHLICHEMTALSPERRE BEI SCHOMBERG IN ZOLLERNALBKREIS),
G. Wagner.
Wasserwirtschaft, Vol 71, No 12, p 364-367, December, 1981. 3 Fig.

Descriptors: *Rockfill dams, *Dam design, *Dam construction, *Maintenance, *Federal Republic of Germany, Schlichem dam, Recreation, Reservoir capacity, Industrial water, Flood protection, Dam stability, Seepage, Dam construction, Filters.

The renovation of the Schlichem dam on the northwestern border of the Swabian Jura (Federal Republic of Germany) and historical circumstances leading up to the renovation are described. The rockfill dam serves three purposes: the provision of industrial water for an oil shale carbonizing plant, flood protection, and recreation. During the planning stage of the dam, begun in 1937, many changes were made with regard to its purpose and size, resulting in the dam being built 5 m higher than originally designed but with its base area remaining almost the same. The faulty design led to a slippage of several hundred cu m as early as 1945, and in 1968 studies revealed that the crown had slipped 33 cm in the horizontal and 25 cm in the vertical plane. Fissures in the crown road surface and in the outlet structure had previously been observed. Renovations were planned in 1970 and begun in 1976. Before the main renovations were started, a rockfill auxiliary dam with a fish ladder was built 1 km upstream of the main dam to function as a boulder and mud catcher and to provide fishing. The main dam consists of supporting bodies of limestone material on both sides with a huge sealing zone of clay-like material and a dome-shaped transition zone in between. However, the water content of the available clay was too high, and together with the too-steep embankment inclination near the crown, caused instability on the downstream side. This will be solved by adding fill so that the base width will be increased 40 m to 120 m. The old crown will be cut down by 5 m and replaced by a more stable material with optimal pore water content. A new filter layer will be constructed from the existing rock supporting body underneath the crown in order to remove a seepage line. Because the existing reservoir capacity is inadequate for flood protection it will be increased to 1.2 cu hm (providing 900,000 cu m for flood waters) by increasing crown height by 2 m. (Gish-FRC)
W83-01111

CONSTRUCTION OF THE DAM TO SUPPLY POTABLE WATER ON THE 'KLEINE KINZIG' RIVER NEAR FREUDENSTADT (BAUABLAUF AN DER TRINKWASSERTALSPERRE KLEINE KINZIG BEI FREUDENSTADT),
Zweckverband Wasserversorgung Kleine Kinzig, Freudenstadt (Germany, F.R.).
F. Frey, and J. Neumann.

Wasserwirtschaft, Vol 71, No 12, p 354-356, December, 1981. 1 Fig. English Summary.

Descriptors: *Rockfill dams, *Dam construction, *Potable water, *Dam design, Hydraulic engineering, *Federal Republic of Germany, Construction, Granites, Crystalline rocks, Concretes, Asphaltic concrete, Grouting, Flood protection, Kleine Kinzig dam.

The state of construction of the Kleine Kinzig dam in the Black Forest, FRG (Federal Republic of Germany) is described. At 70 m, the rock-fill dam, designed to provide drinking water, will be the highest dam with an asphaltic concrete impervious core in the FRG. On both sides of the core is an approximately 1.5-m thick transition layer of syenite with grains of 0/56mm. The downstream pert of the dam consists of material from the valley sides and is covered by an approximately 8-m thick granite covering forming the embankment. The upstream part is filled with granite with a grain size of 0-400 mm, on top of which is a drainage layer of syenite. The construction of a waterworks at the downstream foot of the dam is in progress simultaneously with dam construction. A test filling of granite in the area of the upstream foot took place in late fall, 1980, and withstood the ensuing winter well; vulnerability of the fill to deformation was ruled out. The volume of the dam is 1.4 million cu m. Construction was expected to take 14 months to be complete in late summer 1982. On the upstream side fine-grained granite or syenite must be inserted in the contact zone between valley side and fill. On the downstream foundation surface fissures in the rock are being cleaned and filled. The impervious core is being constructed by a special instrument in 20-cm layers to a thickness of about 65 cm; the transition layers can be completed at the same time. At the end of each work day, the permeable fill is compacted so that possible precipitation will run off. To prevent seepage through and around the dam, a grout curtain is being constructed from the completed control tunnel; the injection program is variable so that the depth of the curtain can be adjusted according to need. (Gish-FRC)
W83-01112

8F. Concrete

KURPSAI HYDROELECTRIC STATION ON THE NARYN RIVER,
For primary bibliographic entry see Field 8A.
W83-01234

8G. Materials

MEASURING STATION TO DETERMINE PORE WATER PRESSURE - ZERVREILA ARCH DAM (MESSANLAGE FUR PORENWASSERDUCK - BOGENSTAUMAUER ZERVREILA),
Solexperts A.G., Zurich (Switzerland).
A. Thut.
Wasser, Energie, Luft, Vol 73, No 4, p 85-86, April, 1981. 4 Fig, 1 Ref.

Descriptors: *Pore pressure, *Dams, *Pressure-measuring instruments, *Piezometers, Gages, Zervreila dam, *Switzerland, Water pressure, Water level fluctuations, Hydraulic engineering, Uplift pressure, Arch dams, Valve transmitters, Gloetzl valve transmitter, Installation, Manometers, Bedrock, Permeability, Geology.

The measuring system installed to determine pore water pressure and uplift at the Zervreila arch dam in Switzerland is described and discussed. The choice of such a measuring system depends on the permeability of the bedrock, the pressures to be measured, and the goal of the measurements. Every change in water level of the dammed lake results in a change in pore water pressure, so that if this pressure is to be determined immediately, volume change in the system must be minimal. With a simple gage, the pressure in the rock is determined by means of water level in the gage pipe; thus when the pressure changes, a time lag occurs while the pipe fills or empties. The filling time of the piezometer pipe is dependent on the permeability of the rock, and for a permeability of 0.0000001 cm/sec the time lag is an unacceptable 17 days. By mounting a manometer at the end of the pipe, the volume change is greatly reduced, but this device requires a water level higher than the manometer and absolute watertightness, and cannot be used continuously due to the inevitable fluctuations in lake level. At the Zervreila dam, Gloetzl-valve transmitters were installed in three storeys to a depth of 41 m. The diameter of the piezometer bore was 76 mm. Near the valve transmitter is a 5-m long filter section of quartz sand. The storey sealing consists of clay balls and cement/water grouting. The valve transmitter consists of a filtering stone and an adjoining small chamber at the transmitter, both of which are saturated before installation. Pore water pressure has a direct effect across the filter and chamber on a membrane behind the water chamber. The volume change is thus completely dependent on water compressibility. In the feed pipe to the transmitter a pressure is produced pneumatically until the membrane opens. (Gish-FRC)
W83-01100

RESULTS OF PRELIMINARY EXPERIMENTS ON THE INFLUENCE OF FABRICS ON THE MIGRATION OF GROUNDWATER AND WATER-SOLUBLE MINERALS IN THE CAPILLARY FRINGE,
Queen Mary Coll., London (England). Dept. of Geological Science.
W. J. French, A. B. Poole, P. Ravenscroft, and M. Khiabani.
Quarterly Journal of Engineering Geology, Vol 15, No 3, p 187-199, 1982. 14 Fig, 6 Tab, 12 Ref.

Descriptors: *Groundwater movement, *Migration, *Minerals, *Capillarity, Capillary water, Groundwater management, Fabrics, Terram, Filtram, Membranes, Permeability, Unsaturated soils.

Laboratory experiments are reported in which soil and groundwater regimes approximating those of hot arid areas have been modelled. The motions of saline groundwater and the solution and precipitation of phases such as halite, gypsum and calcite in the capillary fringe have been studied. Tthe nonwoven permeable fabrics 'Terram' and 'Filtram' have been placed in the soil beds, and it is shown that fabrics such as 'Filtram' are able to prevent both the capillary rise of moisture and the downward penetration of water infiltrating from above. The lower surface of the fabric may act as a locus for mineral precipitation, but crystalline phases have not been found growing into the pores of the fabric. The work is relevant to both horticultural and engineering applications of the fabrics. The first experiments have been followed by larger scale experiments, which are not at this point complete, in which further details of the behavior of permeable membranes in unsaturated soils are being studied, including their ability to protect building materials. (Baker-FRC)
W83-01253

CRITICAL WATER SUPPLY RESTORED: CH2M HILL CALLED TO RESCUE OF COLLAPSED IRRIGATION CANAL.
Irrigation Journal, The Annual Answer Book, Vol. 30, No. 6, p 120, 1980.

Descriptors: *Canals, *Irrigation canals, *Pipes, Conduits, Water conveyance.

A 70-year old concrete irrigation canal, the sole source of water for a $60 million per year orchard crop, was returned to service 18 days after collapse of a 100-ft section located 400 ft up a vertical cliff. The undermining of the foundation was caused by overflow from a cloudburst and clogging with volcanic debris from the Mount St. Helens, Washington, eruption. After debris removal in inhospitable terrain, a helicopter airlifted necessary supplies and equipment. A steel support structure was fabricated in the valley below and 15 ft steel columns were airlifted to the cliff. Six 25-ft sections of 102 inch corrugated steep pipe were lifted from the valley floor and connected to the existing section of the flume. (Cassar-FRC)
W83-01316

8I. Fisheries Engineering

SOME OBSERVATIONS ON THE ECOLOGY AND FISH MANAGEMENT OF RESERVOIRS IN THE UNITED STATES,
Fish and Wildlife Service, Slidell, LA.
For primary bibliographic entry see Field 6G.
W83-01225

SIMULATION OF FISH MOVEMENTS IN A LARGE HYDRO-ELECTRIC RESERVOIR: LG-2,
Sherbrooke Univ. (Quebec). Faculte des Sciences Appliquees.
For primary bibliographic entry see Field 6G.
W83-01229

SOIL CONSERVATION PROTECTS THE TROUT,
Waikato Valley Authority, Hamilton (New Zealand).
For primary bibliographic entry see Field 4D.
W83-01294

10. SCIENTIFIC AND TECHNICAL INFORMATION

10C. Secondary Publication And Distribution

ANNOTATED BIBLIOGRAPHY OF THE GEOLOGY AND HYDROLOGY OF THE SURFICIAL AQUIFERS IN DADE, BROWARD, AND PALM BEACH COUNTIES, FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
C. R. Causaras.
Available from OFSS USGS. Box 25425 Fed. Ctr. Denver, CO 80025. Paper copy $8.00, Microfiche $3.50. Geological Survey Open-File Report 82-154, 1982. 59 p.

Descriptors: *Bibliographics, Hydrology, Geology, Surveys, Aquifers, Groundwater, Water quality, Abstracts, *Florida, Dade County, Broward County, Palm Beach County.

References and abstracts from 149 hydrologic and geologic investigations concerning the surficial aquifers of southeast Florida have been compiled to prepare an annotated bibliography. The references are listed alphabetically by the author's name. (USGS)
W83-01187

SUBJECT INDEX

2

2,4,6-Trinitrotoluene-Surfactant Complexes: Decomposition, Mutagenicity, and Soil Leaching Studies,
W83-01067 5B

ABRASION

Laboratory Investigations of Methods of Protecting Supports from Local Scour,
W83-01098 8B

ACCRETION

Accumulation of Plant Nutrients and Heavy Metals Through Sedimentation Processes and Accretion in a Louisiana Salt Marsh,
W83-01125 2L

ACCUMULATION

Dynamics of Biofilm Processes,
W83-01080 5D

Overview of Phytoplankton Contaminant Problems,
W83-01243 5B

Accumulation of the Polychlorinated Biphenyl Aroclor 1242 from Contaminated Detritus and Water by the Saltmarsh Detritivore, UCA Pugnax,
W83-01394 5B

ACID RAIN

Acid Deposition,
W83-01217 5C

ACIDIC PRECIPITATION

Chemical Interactions Between Forest Soils and Acidic Precipitation During a Dormant Season on Wildcat Run Watershed in Southwestern Pennsylvania,
W83-01236 2K

ACIDIC WATER

Control by Alkaline Neutralization of Trace Elements in Acidic Coal Cleaning Waste Leachates,
W83-01075 5G

Limnology of Opal Lake,
W83-01116 2H

ACTIVATED CARBON

Precipitation Treatment of Municipal Wastewater with Added Activated Carbon (Fallungsreinigung Von Kommunalem Abwasser Mit Zusatz Von Aktivkohle),
W83-01307 5D

ACTIVATED SLUDGE

Causes, Prevention and Control of Bulking Sludge in Activated Sludge Plants (Ursachen, Verhinderung Und Bekampfung Der Blahschlammbildung in Belebungsanlagen),
W83-01325 5D

ACTIVATED SLUDGE PROCESS

Nitrogen Removal by Means of Preliminary Denitrification (Stickstoffelimination Durch Vorgeschaltete Denitrifikation),
W83-01324 5D

First Operational Experience at the Wastewater Treatment Facility of the Breisgauer Bucht Wastewater Association (Erste Betriebserfahrungen auf der Klaranlage des Abwasserzweckverbandes Breisgauer Bucht),
W83-01327 5D

ACTIVITY COEFFIEIENT

Saturated Vapor Pressure of Water and Activity Coefficients of Calcium Chloride in the CaCl2-H20 System at 423-623K,
W83-01250 1A

ADSORPTION

Reversible and Resistant Components of PCB Adsorption-Desorption: Adsorbent Concentration Effects,
W83-01264 5B

AERATION

New Aeration System Cuts Waste Treatment Costs at Badger Paper,
W83-01062 5D

AEROBIC DIGESTION

Optimized Energy Exploitation through Aerobic-Anaerobic Two-Phase Stabilization (Optimierte Energieausnutzung Durch die Aerob-Anaerob Zweiphasen-Stabilisation),
W83-01304 5D

AEROMONAS

Aeromonas Hydrophila Encountered During Survey of Leptospirae in Prawn Farm Pond Water,
W83-01089 5C

AEROSOLS

Overview of Atmospheric Inputs and Losses from Films,
W83-01246 5B

Presence of Enteric Microorganisms in the Air Environment at Wastewater Treatment Plants in Puerto Rico,
W83-01272 5D

AGGRADATION

Dynamics of the Foreshore of a Large Aggradational Feature in the Northwestern Black Sea,
W83-01095 2J

AGROPYRUM JUNCEUM

Responses to Water Stress in Wheat and Related Wild Species,
W83-01145 3F

AIR POLLUTION

The Influence of Atmospheric Nitrogen Influx Upon the Stream Nitrogen Profile of a Relatively Undisturbed Forested Watershed,
W83-01059 5B

Presence of Enteric Microorganisms in the Air Environment at Wastewater Treatment Plants in Puerto Rico,
W83-01272 5D

AIR TEMPERATURE

Surface Layers of Air and Water and their Role in Heat and Moisture Exchange Between a Water Body and the Atmosphere,
W83-01113 2D

Canopy Air Temperatures and Evapotranspiration from Irrigated and Stressed Soybeans,
W83-01313 2D

AIR-WATER INTERFACES

Overview of Phytoplankton Contaminant Problems,
W83-01243 5B

Microbiota in Surface Films: An Historical Perspective,
W83-01245 5B

Overview of Atmospheric Inputs and Losses from Films,
W83-01246 5B

Bacterionueston Involved in the Oxidation of Hydrocarbons at the Air-Water Interface,
W83-01247 5B

Trace Metal Accumulation in Surface Microlayers,
W83-01248 5B

Atmospheric Role in Trace Metal Exchange at the Air-Water Interface,
W83-01255 5B

Pesticide Partitioning in Artificial Surface Films,
W83-01256 5B

Overview of Contaminant Interactions with Surface Films, Zooplankton, and Fish,
W83-01257 5B

Calculated Contribution of Surface Microlayer PCB to Contamination of Lake Michigan Lake Trout,
W83-01258 5B

Enrichment of PCBs in Lake Michigan Surface Films,
W83-01259 5B

Modeling Trace Metals in the Surface Microlayer,
W83-01260 5B

Bacterial Enrichments in Surface Films of Freshwater Lakes,
W83-01261 2H

Effects of Surface Films on Air-Water Exchange Rates,
W83-01262 5C

Short Cycling of Contaminants by Zooplankton and Their Impact on Great Lakes Ecosystems,
W83-01263 5B

Overview of Microbiota in Surface Films,
W83-01265 5B

Fractionation of Hydrophobic Origin Materials in Surface Microlayers,
W83-01266 5B

Models of Particle Dry Deposition to a Lake Surface and Some Effects of Surface Microlayers,
W83-01267 5B

ALASKA

Deep Water Renewals and Oxygen Consumption in an Alaskan Fjord,
W83-01119 2L

Relationships Between Organically Bound Cu Mn in Settling Particulate Matter and Biological Processes in a Subarctic Estuary,
W83-01126 2L

ALBERTA

Watersheds in Muskeg Terrain. 1. The Chemistry of Water Systems,
W83-01206 2K

Modernizing Irrigation Systems in Alberta,
W83-01232 4A

ALFALFA

A Greenhouse Line-Source Sprinkler System for Evaluating Plant Response to a Water Application Gradient,
W83-01162 3F

ALGAE

The Phytoplankton of Some Freshwater Bodies from Zulia State (Venezuela),
W83-01063 2H

Chrysophyceae from Some Greek Lakes,
W83-01064 5C

Algal Growth Stimulus by Phosphorus in Flathead Lake, Montana, Sediments,
W83-01065 5C

The Development of Phytoplankton Populations and Nutrients in a Tidal River Under Drought Conditions,
W83-01283 5B

Treatment of Dairy Waste by Flocculating Algael Bacterial System,
W83-01299 5D

Freshwater Red Algae A New Addition to the Iraqi Flora,
W83-01322 2H

ALGAE

An Investigation into the Removal of Algae by Fine Sand/Silt Filtration,
W83-01367 5D

ALGAL GROWTH
Water Quality Assurance by Phosphorus Reduction in Drinking Water Reservoirs (Sicherung Der Trinkwassergute Als Folge Von Phosphoreliminierungsmassnahmen and Trinkwassertalsperren),
W83-01114 5F

The Influence of Algal Growth and Other Ecological Factors in Reservoirs on the Production and Control of Trihalomethane Precursors,
W83-01279 5F

ALKALINITY
Effect of Container Type on pH and Alkalinity Stability,
W83-01197 5A

ALLUVIAL AQUIFERS
The Hydrogeology of Alluvial Aquifers in or Bordering the Dissected Till Plains,
W83-01269 2F

ALLUVIAL FANS
Sediment Fans and Sediment Flows Generated by Snowmelt: Observations at Austerdalsisen, Norway,
W83-01254 2J

ALPHA FACTOR
Alpha and Beta Factors for Domestic Wastewater,
W83-01207 5D

ALUM
Removal of Colour in Tertiary Treatment of Sanitary Sewage by Chemical Methods,
W83-01300 5D

ALUMINUM
Spectrophotometric Determination of Aluminum in River Water with Bromopyrogallol Red and n-Tetradecyltrimethylammonium Bromide by Flow Injection Analysis,
W83-01389 5A

AMEBAS
Pathogenic Amoebae in Ocean Sediments Near Wastewater Sludge Disposal Sites,
W83-01216 5C

AMMONIUM
Statistical Analysis of Estuarine Profiles: Application to Manganese and Ammonium in the Tamar Estuary,
W83-01154 2L

AMPHIPODS
Time-Dependent Variation of Mercury in a Stream Sediment and the Effect Upon Mercury Content in Gammarus Pulex (L.),
W83-01212 5A

ANAEROBIC DIGESTION
Dynamic Simulator for Anaerobic Digestion Processes,
W83-01105 5D

Optimized Energy Exploitation through Aerobic-Anaerobic Two-Phase Stabilization (Optimierte Energieausnutzung Durch die Aerob-Anaerob Zweiphasen-Stabilisation),
W83-01304 5D

ANKISTRODESMUS FALCATUS
Effects of a Hexachlorobiphenyl and Pentachlorophenol on Growth and Photosynthesis of Phytoplankton,
W83-01242 5C

ANOXIA
Lake Erie Oxygen; The Prehistoric Record,
W83-01231 2H

ANTARCTICA
High Abundance of Algal 24-Ethylcholesterol in Antarctic Lake Sediment,
W83-01373 2H

APPROXIMATION METHOD
Hydrologic Maps of the Ogallala Aquifer, West-Central Kansas, 1979-81,
W83-01188 7C

AQUACULTURE
Aeromonas Hydrophila Encountered During Survey of Leptospirae in Prawn Farm Pond Water,
W83-01089 5C

AQUATIC ANIMALS
The Effects of Recreation on Freshwater Plants and Animals: A Review,
W83-01390 5C

AQUATIC HABITATS
Freshwater Red Algae A New Addition to the Iraqi Flora,
W83-01322 2H

The Selection of Fishery Parameters for Inclusion in the Stream Reach Inventory and Channel Stability Index,
W83-01364 6G

AQUATIC LIFE
Spatial Variations in Abundance of Phytoplankton, Zooplankton, and Larval Fishes in Center Hill Reservoir,
W83-01230 2H

AQUATIC PLANTS
Water Hyacinth for Treating Dairy Waste,
W83-01298 5D

The Effects of Recreation on Freshwater Plants and Animals: A Review,
W83-01390 5C

Enrichment of Copper, Zinc, Manganese, and Iron in Five Species of Pondweeks (Potamogeton Spp.),
W83-01392 5B

AQUATIC PRODUCTIVITY
Use and Limitations of Sedimentary Pigments as Indicators of Past Lake Productivity,
W83-01237 5A

AQUATIC WEED CONTROL *FISH
Grass Carp and Water Weed,
W83-01173 4A

AQUIFER CHARACTERISTICS
Interpretation of pH and Eh Trends in a Fluvial-Sand Aquifer System,
W83-01201 2K

AQUIFER MANAGEMENT
Network Model for Optimal Management of Stream-Aquifer Systems,
W83-01366 4B

AQUIFERS
Map of Water Table in Graham County, Northwestern Kansas, March 1979,
W83-01181 7C

Heat Storage in a Shallow Confined Aquifer: Geophysical Tests to Detect the Resulting Anomaly and Its Evolution with Time,
W83-01205 2F

ARID LANDS
Technical Manual for Groundwater Exploration in Arid and Semiarid Regions Using Landsat Visual and Digital Analyses,
W83-01356 7A

Water Transfer Strategy: Energy Vs. Agricultural Use,
W83-01358 6B

AROCLORS
Fate of Polychlorinated Biphenyls (PCBs) in Soil Plant Systems,
W83-01235 5B

Field and Laboratory Studies of the Toxicity of Phytoplankton of Polychlorinated Biphenyls (PCBs) Desorbed from Fine Clays and Natural Suspended Particulates,
W83-01244 5C

AROMATIC HYDROCARBONS
Evaluation of Microcosms for Determining the Fate and Effect of Benz(a)anthracene in Aquatic Systems,
W83-01282 5B

ARTIFICIAL RECHARGE
Network Model for Optimal Management of Stream-Aquifer Systems,
W83-01366 4B

ATMOSPHERIC WATER
Comparative Study and Calibration of Sensors for the Measurement of the Liquid Water Content of Clouds with Small Droplets,
W83-01091 7B

ATTITUDES
An Investigation of Psychological Components of Water Conservation Behavior,
W83-01363 3D

AUSTRALIA
Tidal Export of Particulate Organic Matter from a Northern Australian Mangrove System,
W83-01124 2L

Preventing Erosion, Landslip and Flooding, A Planning Approach,
W83-01147 6F

BACTERIA
Aeromonas Hydrophila Encountered During Survey of Leptospirae in Prawn Farm Pond Water,
W83-01089 5C

Effect of Microbial Life Stages on the Fate of Methylmercury in Natural Waters,
W83-01104 5B

Epidemiology of Eltor Cholera in Rural Bangladesh: Importance of Surface Water in Transmission,
W83-01107 5C

Microbial Contamination of Continental Shelf Sediments by Wastewater Sludge,
W83-01214 5B

Microbiota in Surface Films: An Historical Perspective,
W83-01245 5B

Bacterionueston Involved in the Oxidation of Hydrocarbons at the Air-Water Interface,
W83-01247 5B

Bacterial Enrichments in Surface Films of Freshwater Lakes,
W83-01261 2H

Overview of Microbiota in Surface Films,
W83-01265 5B

Treatment of Dairy Waste by Flocculating Algael Bacterial System,
W83-01299 5D

BACTERIAL ANALYSIS
Refinement of the Identification and Speciation Schemes of Fecal Streptococci,
W83-01365 5A

BANGLADESH
Epidemiology of Eltor Cholera in Rural Bangladesh: Importance of Surface Water in Transmission,
W83-01107 5C

BATHING
River Water Quality for Bathing Purposes,
W83-01320 5C

BEHAVIOR
An Investigation of Psychological Components of Water Conservation Behavior,
W83-01363 3D

BENTHIC ENVIRONMENT
Limnology of Opal Lake,
W83-01116 2H

BENTHIC FAUNA
The Loch Eil Project: Assessment and Synthesis with a Discussion of Certain Biological Questions Arising from a Study of the Organic Pollution of Sediments,
W83-01086 5C

BENTHOS
Zonation of Inshore Benthos off a Sewage Outfall in Hawke Bay, New Zealand,
W83-01085 5C

Responses of Experimental Estuarine Communities to Continuous Chlorination,
W83-01131 5C

Limnology of Mt. Elbert Forebay 1978-79,
W83-01268 2H

BENZ (A)ANTHRACENE
Evaluation of Microcosms for Determining the Fate and Effect of Benz(a)anthracene in Aquatic Systems,
W83-01282 5B

BETA FACTOR
Alpha and Beta Factors for Domestic Wastewater,
W83-01207 5D

BIBLIOGRAPHICS
Annotated Bibliography of the Geology and Hydrology of the Surficial Aquifers in Dade, Broward, and Palm Beach Counties, Florida,
W83-01187 10C

BIOFILMS
Dynamics of Biofilm Processes,
W83-01080 5D

BIOINDICATORS
Phytoplankton Composition and Distribution as an Expression of Properties of Reservoirs,
W83-01224 2H

BIOLOGICAL OXYGEN DEMAND
Experience Report for Decentralized Wastewater Treatment (Erfahrungsbericht Mit Der Dezentralen Abwasserreinigung),
W83-01326 5D

First Operational Experience at the Wastewater Treatment Facility of the Breisgauer Bucht Wastewater Association (Erste Betriebserfahrungen auf der Klaranlage des Abwasserzweckverbandes Breisgauer Bucht),
W83-01327 5D

BIOLOGICAL WASTEWATER TREATMENT
Mass Transfer in a Rotating Biological Contractor,
W83-01198 5D

SRT Technique in Wastewater Process Design,
W83-01297 5D

BIOMASS
Dynamics of Biofilm Processes,
W83-01080 5D

BIOTA
Evaluation of Microcosms for Determining the Fate and Effect of Benz(a)anthracene in Aquatic Systems,
W83-01282 5B

BLACK SEA
Dynamics of the Foreshore of a Large Aggradational Feature in the Northwestern Black Sea,
W83-01095 2J

BOATING REGULATIONS
Environmental Improvement on Narragansett Bay as a Result of Section 312 Implementation of the Federal Water Pollution Control Act,
W83-01130 5G

BOND ISSUES
Financial Planning During Times of Economic Uncertainty,
W83-01054 6C

Creative Financing Techniques for Water Utilities,
W83-01056 6C

BOTTOM CURRENTS
Density-Driven Interstitial Water Motion in Sediments,
W83-01372 2H

BOTTOM SEDIMENTS
Distributions of Heavy Metals in Bottom Mud and Polygonum Nodosum in the Watarase River (In Japanese),
W83-01175 5B

Adsorption and Desorption of Heavy Metals in Bottom Mud of Urban Rivers,
W83-01194 5B

Time-Dependent Variation of Mercury in a Stream Sediment and the Effect Upon Mercury Content in Gammarus Pulex (L.),
W83-01212 5A

210Pb Geochronology and Trace Metal Concentrations of Sediments from Upper Klamath Lake and Lake Euwana, Oregon,
W83-01252 2J

BOUNDARY DISPUTES
Federal Common Law and its Application to Disputes Involving Accretive and Avulsive Changes in the Bounds of Navigable Waters,
W83-01160 6E

BRIDGE DESIGN
Laboratory Investigations of Methods of Protecting Supports from Local Scour,
W83-01098 8B

BRINES
Chemical Osmosis, Reverse Chemical Osmosis, and the Origin of Subsurface Brines,
W83-01143 2K

BRITISH COLUMBIA
Isotope Hydrogeology and Geothermometry of the Mount Meager Geothermal Area,
W83-01102 2F

Analysis of Freeze-Up Ice Jams on the Peace River Near Taylor, British Columbia,
W83-01103 2C

Geochemical Denudation Rates and Solute Transport Mechanisms in a Maritime Temperate Glacier Basin,
W83-01109 2C

Factors Affecting the Distribution of the Bivalve, Macoma Balthica (L.) on a Mudflat Receiving Sewage Effluent, Fraser River Estuary, British Columbia,
W83-01127 5C

Effects of Artificial Conifer Foliage on Collection of Precipitation and Nutrients in Coastal British Columbia,
W83-01218 2I

Patterns of Circulation and Nutrient Supply in a Medium Residence-Time Reservoir Kootenay Lake, British Columbia,
W83-01223 2H

BROMIDE
What's in the Water,
W83-01292 5A

BULKING SLUDGE
Causes, Prevention and Control of Bulking Sludge in Activated Sludge Plants (Ursachen, Verhinderung Und Bekampfung Der Blahschlammbildung in Belebungsanlagen),
W83-01325 5D

CADDISFLIES
Shifts in Caddisfly Species Composition in Sacramento River Invertebrate Communities in the Presence of Heavy Metal Contamination,
W83-01382 5C

CADMIUM
Leaching of Cadmium from Pigmented Plastics in a Landfill Site,
W83-01068 5B

The Distribution of Lead, Zinc and Cadmium in Sediments of an Ore-Enriched Lotic Ecosystem, the River Ecclesbourne, Derbyshire,
W83-01073 5B

CALCIUM CHLORIDE
Saturated Vapor Pressure of Water and Activity Coefficients of Calcium Chloride in the CaCl2-H20 System at 423-623K,
W83-01250 1A

CALIFORNIA
Low-Frequency Variations in Sea Level and Currents in South San Francisco Bay,
W83-01057 2L

Legal Issues in Implementing Water Reuse in California,
W83-01074 6E

Desalination-Power Cycles with the Biphase Rotary Separator Turbine, Phase 3,
W83-01370 3A

Shifts in Caddisfly Species Composition in Sacramento River Invertebrate Communities in the Presence of Heavy Metal Contamination,
W83-01382 5C

A Study of Well Water in Selected California Communities for Residues of 1,3-Dichloropropene, Chloroallyl Alcohol and 49 Organophosphate or Chlorinated Hydrocarbon Pesticides,
W83-01396 5B

CAMP SITES
Stream Water Quality in a Small Commercial Campground in Colorado,
W83-01090 5B

CANALS
Critical Water Supply Restored: CH2M Hill Called to Rescue of Collapsed Irrigation Canal.
W83-01316 8G

CANDIDA
Relationships Between Candida Albicans and Traditional Bacterial Indicators of Pollution in Wastewater and Receiving Waters,
W83-01362 5A

CAPILLARITY
Stability Analysis of Water Movement in Unsaturated Porous Materials. I. Theoretical Considerations,
W83-01200 2G

CAPILLARITY

Results of Preliminary Experiments on the Influence of Fabrics on the Migration of Groundwater and Water-Soluble Minerals in the Capillary Fringe,
W83-01253 8G

CAPITAL COSTS
Funding Improvements with Debt Capital and Revenues,
W83-01055 6C

Stochastic Approach to Evaluating the Effectiveness of Reclamation Measures,
W83-01093 6A

CARCINOGENS
Evaluation of Microcosms for Determining the Fate and Effect of Benz(a)anthracene in Aquatic Systems,
W83-01282 5B

CASPIAN SEA
Inflow and Levels of the Caspian Sea and Their Variations Under the Effect of Climatic Factors and Economic Activity,
W83-01094 4A

Chemical Model of Caspian Sea Water,
W83-01251 2K

CATCHMENTS
Diurnal Variation of Rainfall in the Upper Catchments of North Bengal Rivers,
W83-01377 2B

CAVITATION
Predicting Cavitation in Tunnel Spillways,
W83-01285 8B

Erosion of Jets with Cavitation Inducers,
W83-01287 8B

CELLULOSE ACETATE MEMBRANES
Isolation and Control of Membrane Filter Degrading Microorganisms,
W83-01359 3A

CHANNEL FLOW
The Effect of Aspect Ratio on Longitudinal Diffusivity in Rectangular Channels,
W83-01115 8B

New Data on Shape Effects in Smooth Rectangular Channels,
W83-01221 8B

CHANNEL MORPHOLOGY
New Data on Shape Effects in Smooth Rectangular Channels,
W83-01221 8B

CHANNEL SCOUR
Laboratory Investigations of Methods of Protecting Supports from Local Scour,
W83-01098 8B

CHANNELS
Direct Solution for Uniform Flows in Elliptical Channels,
W83-01284 8B

The Selection of Fishery Parameters for Inclusion in the Stream Reach Inventory and Channel Stability Index,
W83-01364 6G

CHELATION
Chemical Studies of Copper-Organic Complexes Isolated from Estuarine Waters Using C18 Reverse-Phase Liquid Chromatography,
W83-01139 5A

Mobilization of Copper from Modified Peat by Dissolved Organic Matter in Natural Waters and Biologically Purified Wastewaters,
W83-01341 5B

CHEMICAL ANALYSIS
Statistical Analysis of Estuarine Profiles: Application to Manganese and Ammonium in the Tamar Estuary,
W83-01154 2L

CHEMICAL COMPOSITION
Watersheds in Muskeg Terrain. 1. The Chemistry of Water Systems,
W83-01206 2K

Chemical Model of Caspian Sea Water,
W83-01251 2K

CHEMICAL INTERACTIONS
Chemical Interactions Between Forest Soils and Acidic Precipitation During a Dormant Season on Wildcat Run Watershed in Southwestern Pennsylvania,
W83-01236 2K

CHEMICAL OSMOSIS
Chemical Osmosis, Reverse Chemical Osmosis, and the Origin of Subsurface Brines,
W83-01143 2K

CHEMICAL PROPERTIES
Major Ion Chemistry of Some Large Chinese Rivers,
W83-01374 2K

CHEMICAL REACTIONS
Laboratory Simulation of Chemical Processes Induced by Estuarine Mixing: The Behaviour of Iron and Phosphate in Estuaries,
W83-01120 2L

CHEMICAL TREATMENT
Removal of Humic Substances and Turbidity in Water Supply Sources by Polymer Coagulation and Direct Filtration,
W83-01239 5F

CHESAPEAKE BAY
On the Use of the Nephelometer in Estuarine Waters,
W83-01135 5A

CHINA
Major Ion Chemistry of Some Large Chinese Rivers,
W83-01374 2K

CHLORAMINES
Treatment Technology to Meet the Drinking Water Standards for Trihalomethanes for Jackson, Mississippi,
W83-01360 5F

CHLORIDE
What's in the Water,
W83-01292 5A

CHLORINATED HYDROCARBONS
Equilibrium Distribution Coefficients for Extraction of Chlorinated Hydrocarbons and Aromatics from Water into Undecane,
W83-01076 5D

Photolysis of Hexachlorocyclopentadiene in Water,
W83-01079 5B

Effects of a Hexachlorobiphenyl and Pentachlorophenol on Growth and Photosynthesis of Phytoplankton,
W83-01242 5C

Overview of Phytoplankton Contaminant Problems,
W83-01243 5B

Calculated Contribution of Surface Microlayer PCB to Contamination of Lake Michigan Lake Trout,
W83-01258 5B

Quantitative Determination of Volatile Halogenated Hydrocarbons in Water Samples by Capillary Gas Chromatography and Electron Capture Detection,
W83-01338 5A

A Study of Well Water in Selected California Communities for Residues of 1,3-Dichloropropene, Chloroallyl Alcohol and 49 Organophosphate or Chlorinated Hydrocarbon Pesticides,
W83-01396 5B

CHLORINATION
Responses of Experimental Estuarine Communities to Continuous Chlorination,
W83-01131 5C

Removal of Humic Substances and Turbidity in Water Supply Sources by Polymer Coagulation and Direct Filtration,
W83-01239 5F

Treatment Technology to Meet the Drinking Water Standards for Trihalomethanes for Jackson, Mississippi,
W83-01360 5F

Relationships Between Candida Albicans and Traditional Bacterial Indicators of Pollution in Wastewater and Receiving Waters,
W83-01362 5A

CHLOROPHYLL A
Simple Trophic State Classification of the Canadian Nearshore Waters of the Great Lakes,
W83-01199 5C

CHLOROPHYTA
The Phytoplankton of Some Freshwater Bodies from Zulia State (Venezuela),
W83-01063 2H

CHOLERA
Epidemiology of Eltor Cholera in Rural Bangladesh: Importance of Surface Water in Transmission,
W83-01107 5C

CHROMATOGRAPHY
Chemical Studies of Copper-Organic Complexes Isolated from Estuarine Waters Using C18 Reverse-Phase Liquid Chromatography,
W83-01139 5A

CHRYSOPHYTA
Chrysophyceae from Some Greek Lakes,
W83-01064 5C

CLARIFIERS
Operational Experiences with a Pulsator Clarifier Treating a Coloured Upland Water,
W83-01302 5F

CLAYS
Field and Laboratory Studies of the Toxicity of Phytoplankton of Polychlorinated Biphenyls (PCBs) Desorbed from Fine Clays and Natural Suspended Particulates,
W83-01244 5C

CLEANING
Development of New Cleaning Techniques for Reverse Osmosis Membranes,
W83-01369 3A

CLOUDS
Comparative Study and Calibration of Sensors for the Measurement of the Liquid Water Content of Clouds with Small Droplets,
W83-01091 7B

COAGULATION
Decolorization of Infiltration Water Under Natural Conditions,
W83-01097 2F

Removal of Humic Substances and Turbidity in Water Supply Sources by Polymer Coagulation and Direct Filtration,
W83-01239 5F

COAL
Water Quality Considerations in the Slurry Pipelining of Coal,
W83-01273 5B

COAL GASIFICATION
Organic Contaminants in Groundwater Near an Underground Coal Gasification Site in Northeastern Wyoming,
W83-01066 5B

COAL SLURRY PIPELINES
Water Quality Considerations in the Slurry Pipelining of Coal,
W83-01273 5B

COASTAL MARSHES
Some Diatoms from Brackish Water Habitats in Southern Iraq,
W83-01306 2L

COASTAL ZONE MANAGEMENT
Environmental Improvement on Narragansett Bay as a Result of Section 312 Implementation of the Federal Water Pollution Control Act,
W83-01130 5G

COLIFORMS
Presence of Enteric Microorganisms in the Air Environment at Wastewater Treatment Plants in Puerto Rico,
W83-01272 5D

COLLAPSE
Opinion,
W83-01346 5G

COLOR
Decolorization of Infiltration Water Under Natural Conditions,
W83-01097 2F

Removal of Humic Substances and Turbidity in Water Supply Sources by Polymer Coagulation and Direct Filtration,
W83-01239 5F

Environmental Factors Promoting and Regulating N2 Fixing Blue-Green Algal Blooms in the Chowan River, NC,
W83-01357 5C

COLOR REMOVAL
Removal of Colour in Tertiary Treatment of Sanitary Sewage by Chemical Methods,
W83-01300 5D

Operational Experiences with a Pulsator Clarifier Treating a Coloured Upland Water,
W83-01302 5F

COLORADO
Stream Water Quality in a Small Commercial Campground in Colorado,
W83-01090 5B

Effects of Residential Wastewater-Treatment Systems on Ground-Water Quality in West-Central Jefferson County, Colorado,
W83-01182 5C

Network Model for Optimal Management of Stream-Aquifer Systems,
W83-01366 4B

COMBINED TREATMENT
Precipitation Treatment of Municipal Wastewater with Added Activated Carbon (Fallungsreinigung Von Kommunalem Abwasser Mit Zusatz Von Aktivkohle),
W83-01307 5D

COMPOSITE TROPHIC INDEX
Simple Trophic State Classification of the Canadian Nearshore Waters of the Great Lakes,
W83-01199 5C

COMPUTER MODELS
Stochastic Approach to Evaluating the Effectiveness of Reclamation Measures,
W83-01093 6A

Network Model for Optimal Management of Stream-Aquifer Systems,
W83-01366 4B

COMPUTERS
Scheduling Irrigation by Computer,
W83-01166 3F

Development of a 100,000 GPD Brackish Water Module,
W83-01352 3A

CONCRETE CONSTRUCTION
Kurpsai Hydroelectric Station on the Naryn River,
W83-01234 8A

CONCRETE DAMS
Kurpsai Hydroelectric Station on the Naryn River,
W83-01234 8A

CONDUITS
Characteristics of a Low-Head Pressure Conduit,
W83-01286 8B

CONFINED AQUIFERS
Heat Storage in a Shallow Confined Aquifer: Geophysical Tests to Detect the Resulting Anomaly and Its Evolution with Time,
W83-01205 2F

Steady Non-Darcy Seepage Through Confined Aquifer of Variable Thickness,
W83-01378 2F

CONJUNCTIVE USE
Network Model for Optimal Management of Stream-Aquifer Systems,
W83-01366 4B

COPPER
Chemical Studies of Copper-Organic Complexes Isolated from Estuarine Waters Using C18 Reverse-Phase Liquid Chromatography,
W83-01139 5A

Mobilization of Copper from Modified Peat by Dissolved Organic Matter in Natural Waters and Biologically Purified Wastewaters,
W83-01341 5B

Influence of Kinetics on the Direct Titration Curves of Natural Water Systems - Theoretical Considerations,
W83-01388 5A

CORRELATION ANALYSIS
Correlation Procedures to Reduce Water Losses (Korrelationsverfahren Zur Wasserverlusminderung),
W83-01305 5F

COST ANALYSIS
Removal of Humic Substances and Turbidity in Water Supply Sources by Polymer Coagulation and Direct Filtration,
W83-01239 5F

An Economic Evaluation of Interbasin Water Transfers: A Case Study of Southwestern Connecticut,
W83-01271 6C

Expansion Planning of Water Supply Projects in Tegucigalpa, Honduras (Ausbauplanung Von Wasserversorgungsprojekten in Tegucigalpa, Honduras),
W83-01343 6A

COSTS
Experience Report for Decentralized Wastewater Treatment (Erfahrungsbericht Mit Der Dezentralen Abwasserreinigung),
W83-01326 5D

Costs of Preventive Maintenance Programs in Wastewater Collection Systems,
W83-01339 5D

CRABS
Accumulation of the Polychlorinated Biphenyl Aroclor 1242 from Contaminated Detritus and Water by the Saltmarsh Detritivore, UCA Pugnax,
W83-01394 5B

CROP PRODUCTION
Stochastic Approach to Evaluating the Effectiveness of Reclamation Measures,
W83-01093 6A

Irrigation for Crops in a Sub-Humid Environment, II. The Water Requirements of Soybeans,
W83-01314 2I

CROP YIELD
Stochastic Approach to Evaluating the Effectiveness of Reclamation Measures,
W83-01093 6A

Irrigation for Crops in a Sub-Humid Environment, I. The Effect of Irrigation on the Growth and Yield of Soybeans,
W83-01288 3F

Moisture Stress in Navy Beans. I. Effect of Withholding Irrigation at Different Phenological Stages on Growth and Yield,
W83-01289 3F

CROSS-SECTIONS
New Data on Shape Effects in Smooth Rectangular Channels,
W83-01221 8B

CUBA
Cuba's Zapata Project,
W83-01328 6G

CURRENTS
Low-Frequency Variations in Sea Level and Currents in South San Francisco Bay,
W83-01057 2L

CYANOPHYTA
The Phytoplankton of Some Freshwater Bodies from Zulia State (Venezuela),
W83-01063 2H

Environmental Factors Promoting and Regulating N2 Fixing Blue-Green Algal Blooms in the Chowan River, NC,
W83-01357 5C

DAIRY INDUSTRY
Treatment of Dairy Waste by Flocculating Algael Bacterial System,
W83-01299 5D

DAM CONSTRUCTION
Dam Kleine Kinzig - Design and Construction (Talsperre Kleine Kinzig - Entwurf Und Ausfuhrung),
W83-01110 8D

The Reconstruction of the Schlichem Barrage Near Schomberg in the Zollernalb District (Die Sanierung Der Schlichemtalsperre Bei Schomberg in Zollernalbkreis),
W83-01111 8D

Construction of the Dam to Supply Potable Water on the 'Kleine Kinzig' River Near Freudenstadt (Bauablauf an Der Trinkwassertalsperre Kleine Kinzig Bei Freudenstadt),
W83-01112 8D

Kurpsai Hydroelectric Station on the Naryn River,
W83-01234 8A

More or Less Water,
W83-01317 6G

DAM DESIGN
Dam Kleine Kinzig - Design and Construction (Talsperre Kleine Kinzig - Entwurf Und Ausfuhrung),
W83-01110 8D

The Reconstruction of the Schlichem Barrage Near Schomberg in the Zollernalb District (Die Sanierung Der Schlichemtalsperre Bei Schomberg in Zollernalbkreis),
W83-01111 8D

Construction of the Dam to Supply Potable Water on the 'Kleine Kinzig' River Near Freudenstadt (Bauablauf an Der Trinkwassertalsperre Kleine Kinzig Bei Freudenstadt),
W83-01112 8D

Kurpsai Hydroelectric Station on the Naryn River,
W83-01234 8A

DAM EFFECTS
Inflow and Levels of the Caspian Sea and Their Variations Under the Effect of Climatic Factors and Economic Activity,
W83-01094 4A

DAM FOUNDATIONS
Kurpsai Hydroelectric Station on the Naryn River,
W83-01234 8A

DAMARISCOTTA RIVER ESTUARY
Structural Analysis of Fouling Community Development in the Damariscotta River Estuary, Maine,
W83-01117 2L

DAMS
Measuring Station to Determine Pore Water Pressure - Zervreila Arch Dam (Messanlage Fur Porenwasserduck - Bogenstaumauer Zervreila),
W83-01100 8G

Analysis of Freeze-Up Ice Jams on the Peace River Near Taylor, British Columbia,
W83-01103 2C

Aswan - Dam and Be Damned.
W83-01156 4A

DATA COLLECTIONS
Precipitation Data for Burial Grounds 5 and 6, Oak Ridge National Laboratory, Tennessee, 1976-1980,
W83-01183 7C

DATA PROCESSING
A Microprocessor Controlled System for Storm Water Sampling (Ein Mikroprozessor-Gesteurtes System Zur Probennahme Aus Regeneasserkanalen),
W83-01342 7A

DDT
Mass Balance Modeling of DDT Dynamics in Lakes Michigan and Superior,
W83-01069 5B

DECOMPOSITION
2,4,6-Trinitrotoluene-Surfactant Complexes: Decomposition, Mutagenicity, and Soil Leaching Studies,
W83-01067 5B

Fate of Polychlorinated Biphenyls (PCBs) in Soil Plant Systems,
W83-01235 5B

DEEP WATER
Deep Water Renewals and Oxygen Consumption in an Alaskan Fjord,
W83-01119 2L

DEFORMATION
Laboratory Investigation of the Structure of the Flow and Bottom Features in River Mouth Regions,
W83-01099 2E

DEGRADATION
Photolysis of Hexachlorocyclopentadiene in Water,
W83-01079 5B

Saline Ground-Water Discharge to the Smoky Hill River Between Salina and Abilene, Central Kansas,
W83-01191 5G

Microbiota in Surface Films: An Historical Perspective,
W83-01245 5B

DEICERS
An Analysis of Factors Influencing De-Icing Salt Levels in Streams,
W83-01088 5B

DELAWARE
Uranium, Thorium and Lead Nuclides in a Delaware Salt Marsh Sediment,
W83-01123 5B

DELTAS
Some Diatoms from Brackish Water Habitats in Southern Iraq,
W83-01306 2L

DENITRIFICATION
Nitrogen Removal With Rotating Disc System (Stickstoffelimination Mit Dem Tauchtropfkorper),
W83-01323 5D

Nitrogen Removal by Means of Preliminary Denitrification (Stickstoffelimination Durch Vorgeschaltete Denitrifikation),
W83-01324 5D

DENSITY CURRENTS
Stable Density Fronts and Dinoflagellate Patches in a Tidal Estuary,
W83-01121 2L

The Tidal Instrusion Front: An Estuarine Convergence Zone,
W83-01177 2L

DENTRIFICATION
Mass Transfer in a Rotating Biological Contractor,
W83-01198 5D

DEPOSITION
Models of Particle Dry Deposition to a Lake Surface and Some Effects of Surface Microlayers,
W83-01267 5B

DESALINATION
Evaluation of Desalination Technology for Wastewater Reuse.
W83-01270 5D

Application of Non-Fouling Ultrafiltration Membranes in Water Conversion Technology,
W83-01277 3A

Isolation and Control of Membrane Filter Degrading Microorganisms,
W83-01359 3A

Desalination-Power Cycles with the Biphase Rotary Separator Turbine, Phase 3,
W83-01370 3A

DESALINATION APPARATUS
Development of a 100,000 GPD Brackish Water Module,
W83-01352 3A

Development of New Cleaning Techniques for Reverse Osmosis Membranes,
W83-01369 3A

DESIGN CRITERIA
Direct Solution for Uniform Flows in Elliptical Channels,
W83-01284 8B

SRT Technique in Wastewater Process Design,
W83-01297 5D

Some Design Factors for the Bath County Trashracks,
W83-01312 8C

Low Cost Technology for Disposal of Human Excreta with Community Latrines,
W83-01319 5D

Frito-Lay Turns Waste Into Profit.
W83-01351 5D

Process Design of Anaerobic Sludge Digestion,
W83-01353 5D

DETERGENTS
Anionic Surfactant Concentration in the River and Sea Waters of Hyogo Pref. and its Relationship to Phosphorus Concentration, (In Japanese),
W83-01152 5B

DEVELOPING COUNTRIES
Efficiency of Resource Use Under Small-Scale Irrigation Technology in Nigeria,
W83-01083 6B

DEWATERING
Effluent--A Question of Sludge,
W83-01334 5E

DIATOMS
The Development of Phytoplankton Populations and Nutrients in a Tidal River Under Drought Conditions,
W83-01283 5B

Some Diatoms from Brackish Water Habitats in Southern Iraq,
W83-01306 2L

DIFFERENTIAL EQUATIONS
Similarity Solutions of the Porous Media Equation,
W83-01058 2F

DIGESTION
Evaluation of a Persulfate Digestion Method for Particulate Nitrogen and Phosphorus,
W83-01196 5A

DINOFLAGELLATES
Stable Density Fronts and Dinoflagellate Patches in a Tidal Estuary,
W83-01121 2L

DISINFECTION
Treatment Technology to Meet the Drinking Water Standards for Trihalomethanes for Jackson, Mississippi,
W83-01360 5F

Evaluation of the Use of Iodine for Disinfection of Effluent from On-Site 'Package' Wastewater Treatment Systems,
W83-01361 5D

DISSOLVED ORGANIC CARBON
The Influence of Algal Growth and Other Ecological Factors in Reservoirs on the Production and Control of Trihalomethane Precursors,
W83-01279 5F

Mobilization of Copper from Modified Peat by Dissolved Organic Matter in Natural Waters and Biologically Purified Wastewaters,
W83-01341 5B

DISSOLVED OXYGEN
Alpha and Beta Factors for Domestic Wastewater,
W83-01207 5D

Mathematical Model for Dissolved Oxygen in Three Southern Ontario Reservoirs,
W83-01227 5B

DIURNAL DISTRIBUTION
Diurnal Variation of Rainfall in the Upper Catchments of North Bengal Rivers,
W83-01377 2B

DRAINAGE DITCHES
Solving a Drainage Ditch Vegetation Problem.
W83-01332 4A

DRAINAGE EFFECTS
Recent Increase in Mercury Sedimentation in a Forest Lake Attributable to Peatland Drainage,
W83-01393 5B

DRAINAGE PROGRAMS
Drainage Is the Byword in Louisiana Parish.
W83-01348 4A

DREDGING
Dynamics of Mud (Slick) and Suspended Matter in Estuaries. Applicability of By-Products of Surveys of German Coastal Agencies in View of Requirements for Future Needs,
W83-01161 2J

DRINKING WATER
Water Quality Assurance by Phosphorus Reduction in Drinking Water Reservoirs (Sicherung Der Trinkwassergute Als Folge Von Phosphoreliminierungsmassnahmen and Trinkwassertalsperren),
W83-01114 5F

Acute Fluoride Poisoning Associated with an On-Site Fluoridator in a Vermont Elementary School,
W83-01329 5C

The U.S.: Rethinking Filtration and Disinfection,
W83-01331 5F

Treatment Technology to Meet the Drinking Water Standards for Trihalomethanes for Jackson, Mississippi,
W83-01360 5F

DROUGHT CONDITIONS
The Development of Phytoplankton Populations and Nutrients in a Tidal River Under Drought Conditions,
W83-01283 5B

DROUGHT RESISTANCE
Responses to Water Stress in Wheat and Related Wild Species,
W83-01145 3F

DROUGHTS
Planning for Droughts,
W83-01347 6D

DYE RELEASES
Time of Travel of Solutes in the Vermilion River, Louisiana,
W83-01189 5B

ECONOMIC ASPECTS
Funding Improvements with Debt Capital and Revenues,
W83-01055 6C

Creative Financing Techniques for Water Utilities,
W83-01056 6C

The Role of Investment Banking Firms in Managing Water Project Financing,
W83-01081 6C

ECONOMIC DEVELOPMENT
Efficiency of Resource Use Under Small-Scale Irrigation Technology in Nigeria,
W83-01083 6B

Inflow and Levels of the Caspian Sea and Their Variations Under the Effect of Climatic Factors and Economic Activity,
W83-01094 4A

ECOSYSTEMS
Path Analysis of a Reservoir Ecosystem Model,
W83-01228 6G

EFFLUENT
Evaluation of the Use of Iodine for Disinfection of Effluent from On-Site 'Package' Wastewater Treatment Systems,
W83-01361 5D

EFFLUENT SEEPAGE
Seepage Ponds to Recycle Municipal Wastewater,
W83-01238 5D

EFFLUENTS
Streamflow and Water-Quality Conditions, Wilsons Creek and James River, Springfield Area, Missouri,
W83-01192 4C

EGYPT
Aswan - Dam and Be Damned.
W83-01156 4A

ELECTRICAL RESISTIVITY
Heat Storage in a Shallow Confined Aquifer: Geophysical Tests to Detect the Resulting Anomaly and Its Evolution with Time,
W83-01205 2F

ELECTRODIALYSIS
Evaluation of Desalination Technology for Wastewater Reuse.
W83-01270 5D

ENERGY
Energy Flow in the Ythan Estuary, Aberdeenshire, Scotland,
W83-01122 2L

Optimized Energy Exploitation through Aerobic-Anaerobic Two-Phase Stabilization (Optimierte Energieausnutzung Durch die Aerob-Anaerob Zweiphasen-Stabilisation),
W83-01304 5D

Water Transfer Strategy: Energy Vs. Agricultural Use,
W83-01358 6B

ENGLAND
The Distribution of Lead, Zinc and Cadmium in Sediments of an Ore-Enriched Lotic Ecosystem, the River Ecclesbourne, Derbyshire,
W83-01073 5B

A Note on Tidal Asymmetry in the Severn Estuary,
W83-01134 2L

The Deposition of Windscale Radiocaesium in the Wyre Estuary and the Measurement of Sedimentation Rates,
W83-01138 5B

An Improved Method of Determining Sedimentation Rates by the Use of Artificial Radionuclides,
W83-01153 2J

Statistical Analysis of Estuarine Profiles: Application to Manganese and Ammonium in the Tamar Estuary,
W83-01154 2L

Primary Production in a Turbid Estuary,
W83-01155 2L

Velocity Variations in Salt Marsh Creeks, Norfolk, England,
W83-01176 2L

The Influence of Low-Angled Topography on Hillslope Soil-Water Convergence and Stream Discharge,
W83-01213 2G

Egham Expansion Provides Bulk Water Supply.
W83-01335 5F

Primary Sludge Mass Flow Measurement,
W83-01336 5E

ENRICHMENT
Overview of Atmospheric Inputs and Losses from Films,
W83-01246 5B

Trace Metal Accumulation in Surface Microlayers,
W83-01248 5B

Atmospheric Role in Trace Metal Exchange at the Air-Water Interface,
W83-01255 5B

Pesticide Partitioning in Artificial Surface Films,
W83-01256 5B

Overview of Contaminant Interactions with Surface Films, Zooplankton, and Fish,
W83-01257 5B

Calculated Contribution of Surface Microlayer PCB to Contamination of Lake Michigan Lake Trout,
W83-01258 5B

Enrichment of PCBs in Lake Michigan Surface Films,
W83-01259 5B

Modeling Trace Metals in the Surface Microlayer,
W83-01260 5B

Overview of Microbiota in Surface Films,
W83-01265 5B

ENTERIC BACTERIA
In Situ Survival of Enteric Bacteria in Estuarine Environments of Different Nutrient Characteristics,
W83-01281 2L

ENTRAINMENT
Simulating the Lateral Transport of Ichthyoplankton in the Potomac Estuary,
W83-01136 2L

ENVIRONMENTAL EFFECTS
Simulating the Lateral Transport of Ichthyoplankton in the Potomac Estuary,
W83-01136 2L

Ohiwa Harbour, Natural Values,
W83-01146 6G

The Effects of Mining Southland Lignite on Water and Soil Resources,
W83-01151 6G

Aswan - Dam and Be Damned.
W83-01156 4A

Tutira, A Lake Worth Restoring,
W83-01165 5G

Mahurangi, Problems of Management,
W83-01168 6G

Simulation of Fish Movements in a Large Hydro-Electric Reservoir: LG-2,
W83-01229 6G

The Dying Estuary,
W83-01291 6G

More or Less Water,
W83-01317 6G

Cuba's Zapata Project,
W83-01328 6G

EPIDEMIOLOGY
Epidemiology of Eltor Cholera in Rural Bangladesh: Importance of Surface Water in Transmission,
W83-01107 5C

EQUILIBRIUM
Fluid-Mineral Equilibria in a Hydrothermal System, Roosevelt Hot Springs, Utah,
W83-01142 2K

EQUIPMENT
Pitless Equipment,
W83-01349 5F

EROSION
Erosion of Jets with Cavitation Inducers,
W83-01287 8B

EROSION CONTROL
Laboratory Investigations of Methods of Protecting Supports from Local Scour,
W83-01098 8B

Preventing Erosion, Landslip and Flooding, A Planning Approach,
W83-01147 6F

The Te Awa Research: 35 Years of Soil Conservation,
W83-01169 4D

Erosion, Redeposition, and Delivery of Sediment to Midwestern Streams,
W83-01203 4D

Soil Conservation Protects the Trout,
W83-01294 4D

ESCHERICHIA COLI
In Situ Survival of Enteric Bacteria in Estuarine Environments of Different Nutrient Characteristics,
W83-01281 2L

ESTUARIES
Laboratory Investigation of the Structure of the Flow and Bottom Features in River Mouth Regions,
W83-01099 2E

On the Use of the Nephelometer in Estuarine Waters,
W83-01135 5A

The Deposition of Windscale Radiocaesium in the Wyre Estuary and the Measurement of Sedimentation Rates,
W83-01138 5B

Ohiwa Harbour, Natural Values,
W83-01146 6G

Avon-Heathcote, Estuary Under Stress,
W83-01149 5B

An Improved Method of Determining Sedimentation Rates by the Use of Artificial Radionuclides,
W83-01153 2J

Statistical Analysis of Estuarine Profiles: Application to Manganese and Ammonium in the Tamar Estuary,
W83-01154 2L

Dynamics of Mud (Slick) and Suspended Matter in Estuaries. Applicability of By-Products of Surveys of German Coastal Agencies in View of Requirements for Future Needs,
W83-01161 2J

The Estuarine Zone, an Overview,
W83-01163 2L

The Dying Estuary,
W83-01291 6G

ESTUARINE ENVIRONMENT
The Speciation of Ions in Tiber River Estuary Waters,
W83-01118 5B

Laboratory Simulation of Chemical Processes Induced by Estuarine Mixing: The Behaviour of Iron and Phosphate in Estuaries,
W83-01120 2L

Stable Density Fronts and Dinoflagellate Patches in a Tidal Estuary,
W83-01121 2L

Energy Flow in the Ythan Estuary, Aberdeenshire, Scotland,
W83-01122 2L

Factors Affecting the Distribution of the Bivalve, Macoma Balthica (L.) on a Mudflat Receiving Sewage Effluent, Fraser River Estuary, British Columbia,
W83-01127 5C

Responses of Experimental Estuarine Communities to Continuous Chlorination,
W83-01131 5C

Mathematical Model for Partially Mixed Estuaries Using the Turbulence Energy Equation,
W83-01133 2L

A Note on Tidal Asymmetry in the Severn Estuary,
W83-01134 2L

Primary Production in a Turbid Estuary,
W83-01155 2L

The Tidal Instrusion Front: An Estuarine Convergence Zone,
W83-01177 2L

EUTROPHICATION
Water Quality Assurance by Phosphorus Reduction in Drinking Water Reservoirs (Sicherung Der Trinkwassergute Als Folge Von Phosphoreliminierungsmassnahmen and Trinkwassertalsperren),
W83-01114 5F

Stable Density Fronts and Dinoflagellate Patches in a Tidal Estuary,
W83-01121 2L

The Recovery of L. Vesijarvi Following Sewage Diversion,
W83-01158 5G

Tutira, A Lake Worth Restoring,
W83-01165 5G

Potential Eutrophication of the Rideau River by an Urban Waterway: Discussion,
W83-01219 5C

Lake Erie Oxygen; The Prehistoric Record,
W83-01231 2H

Use and Limitations of Sedimentary Pigments as Indicators of Past Lake Productivity,
W83-01237 5A

Recent Investigations on the Eutrophication and Restoration of Lake Constance (Neuere Untersuchungen Uber Die Eutrophierung Und Sanierung Des Bodensees),
W83-01321 5G

Environmental Factors Promoting and Regulating N2 Fixing Blue-Green Algal Blooms in the Chowan River, NC,
W83-01357 5C

EVAPORATION
Evaluation of Desalination Technology for Wastewater Reuse.
W83-01270 5D

EVAPOTRANSPIRATION
A Weighing Lysimeter for Use in Isolated Field Areas,
W83-01308 2G

Canopy Air Temperatures and Evapotranspiration from Irrigated and Stressed Soybeans,
W83-01313 2D

EXTRACTION
Comparison of Continuous Extractors for the Extraction and Concentration of Trace Organics from Water,
W83-01381 5A

FARM MANAGEMENT
The Onflow of Irrigation Schemes,
W83-01318 3B

FARMING
Aswan - Dam and Be Damned.
W83-01156 4A

FATE OF POLLUTANTS
Effect of Microbial Life Stages on the Fate of Methylmercury in Natural Waters,
W83-01104 5B

Fate of Polychlorinated Biphenyls (PCBs) in Soil Plant Systems,
W83-01235 5B

Evaluation of Microcosms for Determining the Fate and Effect of Benz(a)anthracene in Aquatic Systems,
W83-01282 5B

FECAL COLIFORMS
In Situ Survival of Enteric Bacteria in Estuarine Environments of Different Nutrient Characteristics,
W83-01281 2L

FECAL POLLUTION INDICATORS
Refinement of the Identification and Speciation Schemes of Fecal Streptococci,
W83-01365 5A

FEDERAL REPUBLIC OF GERMANY
Dam Kleine Kinzig - Design and Construction (Talsperre Kleine Kinzig - Entwurf Und Ausfuhrung),
W83-01110 8D

The Reconstruction of the Schlichem Barrage Near Schomberg in the Zollernalb District (Die Sanierung Der Schlichemtalsperre Bei Schomberg in Zollernalbkreis),
W83-01111 8D

Construction of the Dam to Supply Potable Water on the 'Kleine Kinzig' River Near Freudenstadt (Bauablauf an Der Trinkwassertalsperre Kleine Kinzig Bei Freudenstadt),
W83-01112 8D

Water Quality Assurance by Phosphorus Reduction in Drinking Water Reservoirs (Sicherung Der Trinkwassergute Als Folge Von Phosphoreliminierungsmassnahmen and Trinkwassertalsperren),
W83-01114 5F

First Operational Experience at the Wastewater Treatment Facility of the Breisgauer Bucht Wastewater Association (Erste Betriebserfahrun-

gen auf der Klaranlage des Abwasserzweckverbandes Breisgauer Bucht),
W83-01327 5D

FEEDING RATES
Effect of Suspended Sediment on Feeding by Larval Herring (Clupea Harengus Harengus L.),
W83-01383 5C

FEEDLOT RUNOFF
Sedimental Journey,
W83-01140 5E

Wastewater Tight,
W83-01141 5G

FEEDLOT WASTES
Sedimental Journey,
W83-01140 5E

Wastewater Tight,
W83-01141 5G

FENCES
Fences for Floodways,
W83-01148 4A

FERMENTATION
Fluidized-Bed Fermenters: A Steady-State Analysis,
W83-01106 5D

FILAMENTOUS MICROORGANISMS
Causes, Prevention and Control of Bulking Sludge in Activated Sludge Plants (Ursachen, Verhinderung Und Bekampfung Der Blahschlammbildung in Belebungsanlagen),
W83-01325 5D

FILMS
Dynamics of Biofilm Processes,
W83-01080 5D

Fluidized-Bed Fermenters: A Steady-State Analysis,
W83-01106 5D

Effects of Surface Films on Air-Water Exchange Rates,
W83-01262 5C

FILTERS
Effluent--A Question of Sludge,
W83-01334 5E

FILTRATION
Removal of Humic Substances and Turbidity in Water Supply Sources by Polymer Coagulation and Direct Filtration,
W83-01239 5F

The U.S.: Rethinking Filtration and Disinfection,
W83-01331 5F

An Investigation into the Removal of Algae by Fine Sand/Silt Filtration,
W83-01367 5D

FINANCING
Financial Planning During Times of Economic Uncertainty,
W83-01054 6C

Funding Improvements with Debt Capital and Revenues,
W83-01055 6C

Creative Financing Techniques for Water Utilities,
W83-01056 6C

The Role of Investment Banking Firms in Managing Water Project Financing,
W83-01081 6C

FINLAND
The Recovery of L. Vesijarvi Following Sewage Diversion,
W83-01158 5G

Enrichment of Copper, Zinc, Manganese, and Iron in Five Species of Pondweeks (Potamogeton Spp.),
W83-01392 5B

Recent Increase in Mercury Sedimentation in a Forest Lake Attributable to Peatland Drainage,
W83-01393 5B

FISH
Simulation of Fish Movements in a Large Hydro-Electric Reservoir: LG-2,
W83-01229 6G

Soil Conservation Protects the Trout,
W83-01294 4D

A Pilot Study of Potential Phenolic Contamination of Fishes in the Columbia River and Tributaries in the Vicinity of Mount St. Helens,
W83-01354 5C

FISH EGGS
Simulating the Lateral Transport of Ichthyoplankton in the Potomac Estuary,
W83-01136 2L

FISH FOOD ORGANISMS
Effect of Suspended Sediment on Feeding by Larval Herring (Clupea Harengus Harengus L.),
W83-01383 5C

FISH MANAGEMENT
Some Observations on the Ecology and Fish Management of Reservoirs in the United States,
W83-01225 6G

FISH POPULATIONS
The Structure of Two South Carolina Estuarine Tide Pool Fish Assemblages,
W83-01137 2L

FISHERIES
Some Observations on the Ecology and Fish Management of Reservoirs in the United States,
W83-01225 6G

FISHERIES MANAGEMENT
A Water Right for Fisheries,
W83-01293 6E

FJORDS
Deep Water Renewals and Oxygen Consumption in an Alaskan Fjord,
W83-01119 2L

Mechanism Governing the Estuarine Circulation in Deep, Strongly Stratified Fjords,
W83-01132 2L

FLOCCULATION
Treatment of Dairy Waste by Flocculating Algael Bacterial System,
W83-01299 5D

FLOOD CONTROL
The Te Awa Research: 35 Years of Soil Conservation,
W83-01169 4D

FLOOD DAMAGE
Fences for Floodways,
W83-01148 4A

FLOOD FLOW
Passage of Floods Over River Floodplains,
W83-01233 2E

FLOOD FREQUENCY
Magnitude and Frequency of Floods from Selected Drainage Basins in South Dakota,
W83-01193 4A

FLOOD PEAK
Magnitude and Frequency of Floods from Selected Drainage Basins in South Dakota,
W83-01193 4A

FLOOD PROFILES
Passage of Floods Over River Floodplains,
W83-01233 2E

FLOOD RECURRENCE INTERVAL
Magnitude and Frequency of Floods from Selected Drainage Basins in South Dakota,
W83-01193 4A

FLOODPLAINS
Erosion, Redeposition, and Delivery of Sediment to Midwestern Streams,
W83-01203 4D

FLOODS
Magnitude and Frequency of Floods from Selected Drainage Basins in South Dakota,
W83-01193 4A

FLORIDA
Annotated Bibliography of the Geology and Hydrology of the Surficial Aquifers in Dade, Broward, and Palm Beach Counties, Florida,
W83-01187 10C

Water-Quality and Hydrogeologic Data for Three Phosphate Industry Waste-Disposal Sites in Central Florida, 1979-80,
W83-01190 7C

FLOW CHARACTERISTICS
The Effect of Aspect Ratio on Longitudinal Diffusivity in Rectangular Channels,
W83-01115 8B

The Dynamics of a River Bend: A Study in Flow and Sedimentary Processes,
W83-01249 2E

Direct Solution for Uniform Flows in Elliptical Channels,
W83-01284 8B

Steady Non-Darcy Seepage Through Confined Aquifer of Variable Thickness,
W83-01378 2F

FLOW MEASUREMENT
Primary Sludge Mass Flow Measurement,
W83-01336 5E

FLOW PATTERN
Laboratory Investigation of the Structure of the Flow and Bottom Features in River Mouth Regions,
W83-01099 2E

FLOW RESISTANCE
New Data on Shape Effects in Smooth Rectangular Channels,
W83-01221 8B

FLOW VELOCITY
Tensor Structure of the Coefficient of Hydraulic Friction,
W83-01096 8B

Laboratory Investigations of Methods of Protecting Supports from Local Scour,
W83-01098 8B

FLUCTUATIONS
Laboratory Investigation of the Structure of the Flow and Bottom Features in River Mouth Regions,
W83-01099 2E

FLUIDIZED-BED
Desalination-Power Cycles with the Biphase Rotary Separator Turbine, Phase 3,
W83-01370 3A

FLUIDIZED BEDS
Fluidized-Bed Fermenters: A Steady-State Analysis,
W83-01106 5D

FLUORESCENCE
Influence of pH on the Fluorescence of Dissolved Organic Matter,
W83-01128 2L

FLUORIDATION
Acute Fluoride Poisoning Associated with an On-Site Fluoridator in a Vermont Elementary School,
W83-01329 5C

FLUVIAL SEDIMENTS
Interpretation of pH and Eh Trends in a Fluvial-Sand Aquifer System,
W83-01201 2K

FLYASH
Sorption of Phenol by Chemically Treated Flyash,
W83-01296 5D

FOOD CHAIN
Fate of Polychlorinated Biphenyls (PCBs) in Soil Plant Systems,
W83-01235 5B

FOOD PROCESSING INDUSTRY
Frito-Lay Turns Waste Into Profit.
W83-01351 5D

FORECASTING
Application of Statistical Methods to Forecasting of Natural Groundwater Tables,
W83-01108 4B

Application of Sacramento River Forecast Model to an Indian Catchment,
W83-01386 2A

FOREST SOILS
Chemical Interactions Between Forest Soils and Acidic Precipitation During a Dormant Season on Wildcat Run Watershed in Southwestern Pennsylvania,
W83-01236 2K

FORESTED WATERSHEDS
The Influence of Atmospheric Nitrogen Influx Upon the Stream Nitrogen Profile of a Relatively Undisturbed Forested Watershed,
W83-01059 5B

FORESTRY
Wood and Water,
W83-01171 6D

FORESTS
Effects of Artificial Conifer Foliage on Collection of Precipitation and Nutrients in Coastal British Columbia,
W83-01218 2I

FOULING
Structural Analysis of Fouling Community Development in the Damariscotta River Estuary, Maine,
W83-01117 2L

FRANCE
Heat Storage in a Shallow Confined Aquifer: Geophysical Tests to Detect the Resulting Anomaly and Its Evolution with Time,
W83-01205 2F

FREEZING
Evaluation of Desalination Technology for Wastewater Reuse.
W83-01270 5D

FREQUENCY ANALYSIS
High Intensity Rainfalls in NZ,
W83-01295 2B

FULVIC ACIDS
Decolorization of Infiltration Water Under Natural Conditions,
W83-01097 2F

FUNGI
Thermophillic and Thermotolerant Fungi Isolated from the Thermal Effluent of Nuclear Power Generating Reactors: Dispersal of Human Opportunistic and Veterinary Pathogenic Fungi,
W83-01375 5C

GAGING
Rainfall Variation Analysis and Optimization of Gaging Systems,
W83-01202 2B

GAGING STATIONS
An Operational Key Station Network for the Sone Catchment,
W83-01384 7A

GAMMARUS
Time-Dependent Variation of Mercury in a Stream Sediment and the Effect Upon Mercury Content in Gammarus Pulex (L.),
W83-01212 5A

GAS CHROMATOGRAPHY
Quantitative Determination of Volatile Halogenated Hydrocarbons in Water Samples by Capillary Gas Chromatography and Electron Capture Detection,
W83-01338 5A

GEOCHEMISTRY
Geochemical Denudation Rates and Solute Transport Mechanisms in a Maritime Temperate Glacier Basin,
W83-01109 2C

Chemical Osmosis, Reverse Chemical Osmosis, and the Origin of Subsurface Brines,
W83-01143 2K

Ground Water Geochemistry of 228Ra, 226Ra, and 222Rn,
W83-01157 5A

GEOHYDROLOGY
The Hydrogeology of Alluvial Aquifers in or Bordering the Dissected Till Plains,
W83-01269 2F

Technical Manual for Groundwater Exploration in Arid and Semiarid Regions Using Landsat Visual and Digital Analyses,
W83-01356 7A

GEOLOGIC FRACTURES
Municipal Fractured-Rock Wells,
W83-01350 3B

GEOLOGY
Dam Kleine Kinzig - Design and Construction (Talsperre Kleine Kinzig - Entwurf Und Ausfuhrung),
W83-01110 8D

GEOMORPHOLOGY
Velocity Variations in Salt Marsh Creeks, Norfolk, England,
W83-01176 2L

GEORGIA
The Establishment of Water Quality Gradients in Reservoirs,
W83-01222 5B

GEOTHERMAL RESOURCES
Isotope Hydrogeology and Geothermometry of the Mount Meager Geothermal Area,
W83-01102 2F

GEOTHERMAL STUDIES
Fluid-Mineral Equilibria in a Hydrothermal System, Roosevelt Hot Springs, Utah,
W83-01142 2K

GERMANY
Dynamics of Mud (Slick) and Suspended Matter in Estuaries. Applicability of By-Products of Surveys of German Coastal Agencies in View of Requirements for Future Needs,
W83-01161 2J

Quantitative Determination of Volatile Halogenated Hydrocarbons in Water Samples by Capillary Gas Chromatography and Electron Capture Detection,
W83-01338 5A

GLACIERS
Geochemical Denudation Rates and Solute Transport Mechanisms in a Maritime Temperate Glacier Basin,
W83-01109 2C

GRAPHICAL ANALYSIS
Modified Graphical Determination of Submain Size,
W83-01101 8C

GRAPHICAL METHODS
Modified Graphical Determination of Submain Size,
W83-01101 8C

GRASS CARP
Grass Carp and Water Weed,
W83-01173 4A

GRAVITY DAMS
Kurpsai Hydroelectric Station on the Naryn River,
W83-01234 8A

GRAVITY FLOW
It's all Downhill from Here. The Erewhon Rural Water Supply Scheme,
W83-01170 8A

GREAT BRITAIN
The Effects of Recreation on Freshwater Plants and Animals: A Review,
W83-01390 5C

GREAT LAKES
Simple Trophic State Classification of the Canadian Nearshore Waters of the Great Lakes,
W83-01199 5C

GREAT LAKES RIVER BASIN
Water Resources Data, Minnesota, Water Year 1981. Volume 1. Great Lakes and Souris-Red-Rainy River Basins.
W83-01398 7C

GREECE
Chrysophyceae from Some Greek Lakes,
W83-01064 5C

GREENHOUSES
A Greenhouse Line-Source Sprinkler System for Evaluating Plant Response to a Water Application Gradient,
W83-01162 3F

GROUNDWATER
Ground Water Geochemistry of 228Ra, 226Ra, and 222Rn,
W83-01157 5A

Water Resources Data, Utah, Water Year 1981.
W83-01178 7C

Water Resources Data, Virginia, Water Year 1981.
W83-01179 7C

Map of Water Table in Graham County, Northwestern Kansas, March 1979,
W83-01181 7C

Effects of Residential Wastewater-Treatment Systems on Ground-Water Quality in West-Central Jefferson County, Colorado,
W83-01182 5C

Water-Table Map of the San Jose Well Field and Vicinity, Albuquerque, New Mexico, Spring 1981,
W83-01184 7C

Ground-Water Quality and Data on Wells and Springs in Pennsylvania, Volume III--Delaware River Basin,
W83-01185 7C

Ground-Water Quality and Data on Wells and Springs in Pennsylvania, Volume II--Susquehanna and Potomac River Basins,
W83-01186 7C

What's in the Water,
W83-01292 5A

Supreme Court Issues Groundwater Rights Ruling,
W83-01337 6E

Technical Manual for Groundwater Exploration in Arid and Semiarid Regions Using Landsat Visual and Digital Analyses,
W83-01356 7A

Water Resources Data, Minnesota, Water Year 1981. Volume 2. Upper Mississippi and Missouri River Basins.
W83-01397 7C

Water Resources Data, Minnesota, Water Year 1981. Volume 1. Great Lakes and Souris-Red-Rainy River Basins.
W83-01398 7C

Water Resources Data, Illinois, Water Year 1981. Volume 2. Illinois River Basin.
W83-01399 7C

Water Resources Data, Illinois, Water Year 1981. Volume 1. Illinois Except Illinois River Basin.
W83-01400 7C

GROUNDWATER LEVEL

Application of Statistical Methods to Forecasting of Natural Groundwater Tables,
W83-01108 4B

GROUNDWATER MANAGEMENT

A Pricing Policy for Groundwater Management in Puerto Rico,
W83-01276 6C

GROUNDWATER MOVEMENT

Similarity Solutions of the Porous Media Equation,
W83-01058 2F

Water-Table Map of the San Jose Well Field and Vicinity, Albuquerque, New Mexico, Spring 1981,
W83-01184 7C

Saline Ground-Water Discharge to the Smoky Hill River Between Salina and Abilene, Central Kansas,
W83-01191 5G

Stability Analysis of Water Movement in Unsaturated Porous Materials. I. Theoretical Considerations,
W83-01200 2G

An Alternative Conceptual Model of Groundwater Flow,
W83-01204 2F

Simulation of Long-Term Transient Density-Dependent Transport in Groundwater,
W83-01220 2F

Results of Preliminary Experiments on the Influence of Fabrics on the Migration of Groundwater and Water-Soluble Minerals in the Capillary Fringe,
W83-01253 8G

The Hydrogeology of Alluvial Aquifers in or Bordering the Dissected Till Plains,
W83-01269 2F

GROUNDWATER POLLUTION

Organic Contaminants in Groundwater Near an Underground Coal Gasification Site in Northeastern Wyoming,
W83-01066 5B

Protecting Public Groundwater Supplies,
W83-01071 5G

Seepage Ponds to Recycle Municipal Wastewater,
W83-01238 5D

Effectiveness of Septic Systems in Safeguarding the Groundwater in Maine,
W83-01278 5G

GROUNDWATER POTENTIAL

Groundwater Buildup and Depletion in Islands During Monsoon and Summer,
W83-01052 2F

GROUNDWATER PROTECTION

Effectiveness of Septic Systems in Safeguarding the Groundwater in Maine,
W83-01278 5G

GROUNDWATER RECHARGE

Interpretation of pH and Eh Trends in a Fluvial-Sand Aquifer System,
W83-01201 2K

GROUNDWATER RUNOFF

Decolorization of Infiltration Water Under Natural Conditions,
W83-01097 2F

GROWTH RATES

Effects of a Hexachlorobiphenyl and Pentachlorophenol on Growth and Photosynthesis of Phytoplankton,
W83-01242 5C

HACKENSACK RIVER

The Development of Phytoplankton Populations and Nutrients in a Tidal River Under Drought Conditions,
W83-01283 5B

HALOGENATED COMPOUNDS

Quantitative Determination of Volatile Halogenated Hydrocarbons in Water Samples by Capillary Gas Chromatography and Electron Capture Detection,
W83-01338 5A

HAWAII

Aeromonas Hydrophila Encountered During Survey of Leptospirae in Prawn Farm Pond Water,
W83-01089 5C

HEAT-EXCHANGER

Desalination-Power Cycles with the Biphase Rotary Separator Turbine, Phase 3,
W83-01370 3A

HEAT FLOW

Heat Storage in a Shallow Confined Aquifer: Geophysical Tests to Detect the Resulting Anomaly and Its Evolution with Time,
W83-01205 2F

HEAT TRANSFER

Surface Layers of Air and Water and their Role in Heat and Moisture Exchange Between a Water Body and the Atmosphere,
W83-01113 2D

HEAVY METALS

Accumulation of Plant Nutrients and Heavy Metals Through Sedimentation Processes and Accretion in a Louisiana Salt Marsh,
W83-01125 2L

Distributions of Heavy Metals in Bottom Mud and Polygonum Nodosum in the Watarase River (In Japanese),
W83-01175 5B

Adsorption and Desorption of Heavy Metals in Bottom Mud of Urban Rivers,
W83-01194 5B

Shifts in Caddisfly Species Composition in Sacramento River Invertebrate Communities in the Presence of Heavy Metal Contamination,
W83-01382 5C

Heavy Metal Concentrations in Shrimp, Crab, and Sediment Obtained from Ad-Dammam Sewage Outfall Area,
W83-01391 5B

Enrichment of Copper, Zinc, Manganese, and Iron in Five Species of Pondweeks (Potamogeton Spp.),
W83-01392 5B

HERBICIDES

Solving a Drainage Ditch Vegetation Problem.
W83-01332 4A

Effects of Water on the Fate of Herbicides in Irrigated Soils,
W83-01355 5B

HERRING

Effect of Suspended Sediment on Feeding by Larval Herring (Clupea Harengus Harengus L.),
W83-01383 5C

HEXACHLOROBIPHENYL

Effects of a Hexachlorobiphenyl and Pentachlorophenol on Growth and Photosynthesis of Phytoplankton,
W83-01242 5C

HEXACHLOROCYCLOPENTADIENE

Photolysis of Hexachlorocyclopentadiene in Water,
W83-01079 5B

HONDURAS

Expansion Planning of Water Supply Projects in Tegucigalpa, Honduras (Ausbauplanung Von Wasserversorgungsprojekten in Tegucigalpa, Honduras),
W83-01343 6A

HOT SPRINGS

Fluid-Mineral Equilibria in a Hydrothermal System, Roosevelt Hot Springs, Utah,
W83-01142 2K

HUMIC ACIDS

Decolorization of Infiltration Water Under Natural Conditions,
W83-01097 2F

HYDRAULIC EQUIPMENT

Axial Flow-Induced Vibrations in Large High-Head Machines,
W83-01311 8C

HYDRAULIC FRICTION

Tensor Structure of the Coefficient of Hydraulic Friction,
W83-01096 8B

HYDRAULIC MACHINERY

Axial Flow-Induced Vibrations in Large High-Head Machines,
W83-01311 8C

HYDROBIOLOGY

The Phytoplankton of Some Freshwater Bodies from Zulia State (Venezuela),
W83-01063 2H

Freshwater Red Algae A New Addition to the Iraqi Flora,
W83-01322 2H

HYDROCARBONS
Bacterionueston Involved in the Oxidation of Hydrocarbons at the Air-Water Interface,
W83-01247 5B

HYDROELECTRIC PLANTS
Kurpsai Hydroelectric Station on the Naryn River,
W83-01234 8A

HYDROGEN ION CONCENTRATION
Influence of pH on the Fluorescence of Dissolved Organic Matter,
W83-01128 2L

Effect of Container Type on pH and Alkalinity Stability,
W83-01197 5A

Interpretation of pH and Eh Trends in a Fluvial-Sand Aquifer System,
W83-01201 2K

HYDROLOGIC BUDGET
Application of Deterministic Conceptual Model for Water Balance Studies,
W83-01387 2A

HYDROLOGIC DATA
Water Resources Data, Utah, Water Year 1981.
W83-01178 7C

Water Resources Data, Virginia, Water Year 1981.
W83-01179 7C

Ground-Water Quality and Data on Wells and Springs in Pennsylvania, Volume III--Delaware River Basin,
W83-01185 7C

Ground-Water Quality and Data on Wells and Springs in Pennsylvania, Volume II--Susquehanna and Potomac River Basins,
W83-01186 7C

Hydrologic Maps of the Ogallala Aquifer, West-Central Kansas, 1979-81,
W83-01188 7C

Water Resources Data, Minnesota, Water Year 1981. Volume 2. Upper Mississippi and Missouri River Basins.
W83-01397 7C

Water Resources Data, Minnesota, Water Year 1981. Volume 1. Great Lakes and Souris-Red-Rainy River Basins.
W83-01398 7C

Water Resources Data, Illinois, Water Year 1981. Volume 2. Illinois River Basin.
W83-01399 7C

Water Resources Data, Illinois, Water Year 1981. Volume 1. Illinois Except Illinois River Basin.
W83-01400 7C

HYDROLOGIC MODELS
Network Model for Optimal Management of Stream-Aquifer Systems,
W83-01366 4B

HYDROLOGIC SYSTEMS
Statistical Characteristics of Some Indian Hydrologic Time Series,
W83-01385 2E

HYDROLOGY
Wood and Water,
W83-01171 6D

HYDROTHERMAL STUDIES
Isotope Hydrogeology and Geothermometry of the Mount Meager Geothermal Area,
W83-01102 2F

ICE JAMS
Analysis of Freeze-Up Ice Jams on the Peace River Near Taylor, British Columbia,
W83-01103 2C

ILLINOIS
Erosion, Redeposition, and Delivery of Sediment to Midwestern Streams,
W83-01203 4D

Usefulness of Sediment Oxygen as a Tool for Impoundment Management,
W83-01371 5B

Water Resources Data, Illinois, Water Year 1981. Volume 2. Illinois River Basin.
W83-01399 7C

Water Resources Data, Illinois, Water Year 1981. Volume 1. Illinois Except Illinois River Basin.
W83-01400 7C

ILLINOIS RIVER BASIN
Water Resources Data, Illinois, Water Year 1981. Volume 2. Illinois River Basin.
W83-01399 7C

INDIA
Groundwater Buildup and Depletion in Islands During Monsoon and Summer,
W83-01052 2F

Infiltration Well Used In Hardwar Water Supply,
W83-01301 6B

Low Cost Technology for Disposal of Human Excreta with Community Latrines,
W83-01319 5D

River Water Quality for Bathing Purposes,
W83-01320 5C

A Conceptual Model of Water Transport Through Unsaturated Soil Zone,
W83-01376 2G

Diurnal Variation of Rainfall in the Upper Catchments of North Bengal Rivers,
W83-01377 2B

Variation of Trace Element Concentration in Rainwater with Rainfall Rate and Rainfall Amount,
W83-01379 5A

An Operational Key Station Network for the Sone Catchment,
W83-01384 7A

Statistical Characteristics of Some Indian Hydrologic Time Series,
W83-01385 2E

Application of Sacramento River Forecast Model to an Indian Catchment,
W83-01386 2A

Application of Deterministic Conceptual Model for Water Balance Studies,
W83-01387 2A

INDIANA
Frito-Lay Turns Waste Into Profit.
W83-01351 5D

Statistical Characteristics of Some Indian Hydrologic Time Series,
W83-01385 2E

INDICATORS
Enrichment of Copper, Zinc, Manganese, and Iron in Five Species of Pondweeks (Potamogeton Spp.),
W83-01392 5B

INDIRECT FLOOD MEASUREMENT
Passage of Floods Over River Floodplains,
W83-01233 2E

INDUSTRIAL WASTES
2,4,6-Trinitrotoluene-Surfactant Complexes: Decomposition, Mutagenicity, and Soil Leaching Studies,
W83-01067 5B

Water Hyacinth for Treating Dairy Waste,
W83-01298 5D

Watching the River's Flow.
W83-01310 5B

INDUSTRIAL WASTEWATER
Water Quality Considerations in the Slurry Pipelining of Coal,
W83-01273 5B

INDUSTRIAL WATER
Water Resource Management and Conservation for the Future,
W83-01274 3D

INFILTRATION
Conservation Tillage Effects on Water Conservation,
W83-01240 3F

INFILTRATION WELLS
Infiltration Well Used In Hardwar Water Supply,
W83-01301 6B

INJECTION
Heat Storage in a Shallow Confined Aquifer: Geophysical Tests to Detect the Resulting Anomaly and Its Evolution with Time,
W83-01205 2F

INTERBASIN TRANSFERS
An Economic Evaluation of Interbasin Water Transfers: A Case Study of Southwestern Connecticut,
W83-01271 6C

INTERSTITIAL WATER
Density-Driven Interstitial Water Motion in Sediments,
W83-01372 2H

INVERTEBRATES
Structural Analysis of Fouling Community Development in the Damariscotta River Estuary, Maine,
W83-01117 2L

Heavy Metal Concentrations in Shrimp, Crab, and Sediment Obtained from Ad-Dammam Sewage Outfall Area,
W83-01391 5B

Accumulation of the Polychlorinated Biphenyl Aroclor 1242 from Contaminated Detritus and Water by the Saltmarsh Detritivore, UCA Pugnax,
W83-01394 5B

INVESTMENT
The Role of Investment Banking Firms in Managing Water Project Financing,
W83-01081 6C

IODINE
Evaluation of the Use of Iodine for Disinfection of Effluent from On-Site 'Package' Wastewater Treatment Systems,
W83-01361 5D

ION EXCHANGE
Evaluation of Desalination Technology for Wastewater Reuse.
W83-01270 5D

Weak-Electrolyte Ion Exchange in Advanced-Technology Water-Reuse Systems,
W83-01275 5D

IONS
The Speciation of Ions in Tiber River Estuary Waters,
W83-01118 5B

Chemical Model of Caspian Sea Water,
W83-01251 2K

Major Ion Chemistry of Some Large Chinese Rivers,
W83-01374 2K

IOWA
High-Density Use of Septic Systems, Avon Lake, Iowa,
W83-01082 5D

IRAQ
Some Diatoms from Brackish Water Habitats in Southern Iraq,
W83-01306 2L

Freshwater Red Algae A New Addition to the Iraqi Flora,
W83-01322 2H

IRON
Laboratory Simulation of Chemical Processes Induced by Estuarine Mixing: The Behaviour of Iron and Phosphate in Estuaries,
W83-01120 2L

IRRIGATION
Efficiency of Resource Use Under Small-Scale Irrigation Technology in Nigeria,
W83-01083 6B

IRRIGATION CANALS
Critical Water Supply Restored: CH2M Hill Called to Rescue of Collapsed Irrigation Canal.
W83-01316 8G

IRRIGATION DESIGN
A Greenhouse Line-Source Sprinkler System for Evaluating Plant Response to a Water Application Gradient,
W83-01162 3F

IRRIGATION EFFECTS
Effects of Water on the Fate of Herbicides in Irrigated Soils,
W83-01355 5B

IRRIGATION EFFICIENCY
Scheduling Irrigation by Computer,
W83-01166 3F

Canopy Air Temperatures and Evapotranspiration from Irrigated and Stressed Soybeans,
W83-01313 2D

IRRIGATION ENGINEERING
It's all Downhill from Here. The Erewhon Rural Water Supply Scheme,
W83-01170 8A

The Onflow of Irrigation Schemes,
W83-01318 3B

IRRIGATION PATTERNS
Computer Evaluation of Sprinkler Irrigation Uniformity,
W83-01290 3F

Irrigation for Crops in a Sub-Humid Environment, II. The Water Requirements of Soybeans,
W83-01314 2I

IRRIGATION PRACTICES
Irrigation for Crops in a Sub-Humid Environment, I. The Effect of Irrigation on the Growth and Yield of Soybeans,
W83-01288 3F

Moisture Stress in Navy Beans. I. Effect of Withholding Irrigation at Different Phenological Stages on Growth and Yield,
W83-01289 3F

IRRIGATION PROJECTS
Modernizing Irrigation Systems in Alberta,
W83-01232 4A

IRRIGATION REQUIREMENTS
Canopy Air Temperatures and Evapotranspiration from Irrigated and Stressed Soybeans,
W83-01313 2D

IRRIGATION SYSTEMS
Modernizing Irrigation Systems in Alberta,
W83-01232 4A

IRRIGATION WATER
Water Transfer Strategy: Energy Vs. Agricultural Use,
W83-01358 6B

ISLANDS
Groundwater Buildup and Depletion in Islands During Monsoon and Summer,
W83-01052 2F

ITALY
The Speciation of Ions in Tiber River Estuary Waters,
W83-01118 5B

JAPAN
Anionic Surfactant Concentration in the River and Sea Waters of Hyogo Pref. and its Relationship to Phosphorus Concentration, (In Japanese),
W83-01152 5B

Distributions of Heavy Metals in Bottom Mud and Polygonum Nodosum in the Watarase River (In Japanese),
W83-01175 5B

Adsorption and Desorption of Heavy Metals in Bottom Mud of Urban Rivers,
W83-01194 5B

Spectrophotometric Determination of Aluminum in River Water with Bromopyrogallol Red and n-Tetradecyltrimethylammonium Bromide by Flow Injection Analysis,
W83-01389 5A

JETS
Erosion of Jets with Cavitation Inducers,
W83-01287 8B

KANSAS
Map of Water Table in Solomon River Valley, Waconda Lake to Solomon, North-Central Kansas, May 1980,
W83-01180 7C

Map of Water Table in Graham County, Northwestern Kansas, March 1979,
W83-01181 7C

Hydrologic Maps of the Ogallala Aquifer, West-Central Kansas, 1979-81,
W83-01188 7C

Saline Ground-Water Discharge to the Smoky Hill River Between Salina and Abilene, Central Kansas,
W83-01191 5G

Conservation Tillage Effects on Water Conservation,
W83-01240 3F

KINETICS
Dynamic Simulator for Anaerobic Digestion Processes,
W83-01105 5D

Influence of Kinetics on the Direct Titration Curves of Natural Water Systems - Theoretical Considerations,
W83-01388 5A

KJELDAHL NITROGEN
Determination of Total Kjeldahl Nitrogen and Total Phosphorus in Surface Waters and Wastewaters,
W83-01210 5A

LAGOONS
Nutrient Enrichment of Seagrass Beds in a Rhode Island Coastal Lagoon,
W83-01129 5C

LAKE CLASSIFICATION
Simple Trophic State Classification of the Canadian Nearshore Waters of the Great Lakes,
W83-01199 5C

LAKE CONSTANCE
Recent Investigations on the Eutrophication and Restoration of Lake Constance (Neuere Untersuchungen Uber Die Eutrophierung Und Sanierung Des Bodensees),
W83-01321 5G

LAKE ERIE
Lake Erie Oxygen; The Prehistoric Record,
W83-01231 2H

LAKE HURON
Reversible and Resistant Components of PCB Adsorption-Desorption: Adsorbent Concentration Effects,
W83-01264 5B

LAKE MICHIGAN
Mass Balance Modeling of DDT Dynamics in Lakes Michigan and Superior,
W83-01069 5B

Atmospheric Role in Trace Metal Exchange at the Air-Water Interface,
W83-01255 5B

Calculated Contribution of Surface Microlayer PCB to Contamination of Lake Michigan Lake Trout,
W83-01258 5B

Enrichment of PCBs in Lake Michigan Surface Films,
W83-01259 5B

Fractionation of Hydrophobic Origin Materials in Surface Microlayers,
W83-01266 5B

Models of Particle Dry Deposition to a Lake Surface and Some Effects of Surface Microlayers,
W83-01267 5B

LAKE MORPHOLOGY
Use and Limitations of Sedimentary Pigments as Indicators of Past Lake Productivity,
W83-01237 5A

LAKE RESTORATION
The Recovery of L. Vesijarvi Following Sewage Diversion,
W83-01158 5G

Changes in the Phytoplankton of Lake Trummen Induced by Restoration,
W83-01159 5G

Tutira, A Lake Worth Restoring,
W83-01165 5G

Recent Investigations on the Eutrophication and Restoration of Lake Constance (Neuere Untersuchungen Uber Die Eutrophierung Und Sanierung Des Bodensees),
W83-01321 5G

LAKE SEDIMENTS
Sedimentation in an Artificial Lake - Lake Matahina, Bay of Plenty,
W83-01084 2J

Use and Limitations of Sedimentary Pigments as Indicators of Past Lake Productivity,
W83-01237 5A

210Pb Geochronology and Trace Metal Concentrations of Sediments from Upper Klamath Lake and Lake Euwana, Oregon,
W83-01252 2J

High Abundance of Algal 24-Ethylcholesterol in Antarctic Lake Sediment,
W83-01373 2H

LAKE SUPERIOR
Mass Balance Modeling of DDT Dynamics in Lakes Michigan and Superior,
W83-01069 5B

Atmospheric Role in Trace Metal Exchange at the Air-Water Interface,
W83-01255 5B

Bacterial Enrichments in Surface Films of Freshwater Lakes,
W83-01261 2H

LAKES
The Phytoplankton of Some Freshwater Bodies from Zulia State (Venezuela),
W83-01063 2H

Chrysophyceae from Some Greek Lakes,
W83-01064 5C

Mass Balance Modeling of DDT Dynamics in Lakes Michigan and Superior,
W83-01069 5B

Deposition and Chemistry of Pollutant Metals in Lakes Around the Smelters at Sudbury, Ontario,
W83-01078 5B

Sedimentation in an Artificial Lake - Lake Matahina, Bay of Plenty,
W83-01084 2J

Limnology of Opal Lake,
W83-01116 2H

Acid Deposition,
W83-01217 5C

Lake Erie Oxygen; The Prehistoric Record,
W83-01231 2H

LAND APPLICATION
Sludge Marketing: The Quiet Revolution,
W83-01208 5E

LAND DISPOSAL
Where We Are But Where Are We Going,
W83-01215 5E

LAND RECLAMATION
Stochastic Approach to Evaluating the Effectiveness of Reclamation Measures,
W83-01093 6A

Drainage Is the Byword in Louisiana Parish.
W83-01348 4A

LANDFILLS
Leaching of Cadmium from Pigmented Plastics in a Landfill Site,
W83-01068 5B

LANDSAT
Technical Manual for Groundwater Exploration in Arid and Semiarid Regions Using Landsat Visual and Digital Analyses,
W83-01356 7A

LARVAE
Effect of Suspended Sediment on Feeding by Larval Herring (Clupea Harengus Harengus L.),
W83-01383 5C

LEACHATES
Control by Alkaline Neutralization of Trace Elements in Acidic Coal Cleaning Waste Leachates,
W83-01075 5G

LEACHING
2,4,6-Trinitrotoluene-Surfactant Complexes: Decomposition, Mutagenicity, and Soil Leaching Studies,
W83-01067 5B

The Septic Tank as a Wastewater Treatment and Disposal Facility,
W83-01241 5D

Effects of Water on the Fate of Herbicides in Irrigated Soils,
W83-01355 5B

LEAD
The Distribution of Lead, Zinc and Cadmium in Sediments of an Ore-Enriched Lotic Ecosystem, the River Ecclesbourne, Derbyshire,
W83-01073 5B

Influence of Particle Size Distribution on Water Quality in Agricultural Impoundments,
W83-01280 5B

LEAKAGE
Correlation Procedures to Reduce Water Losses (Korrelationsverfahren Zur Wasserverlusminderung),
W83-01305 5F

Sliplining Ends Gadsden Infiltration.
W83-01344 5G

LEGAL ASPECTS
Legal Issues in Implementing Water Reuse in California,
W83-01074 6E

Federal Common Law and its Application to Disputes Involving Accretive and Avulsive Changes in the Bounds of Navigable Waters,
W83-01160 6E

The National Development Act and Regional Water Boards,
W83-01167 6E

Supreme Court Issues Groundwater Rights Ruling,
W83-01337 6E

LIMNMOLOGY
Limnology of Mt. Elbert Forebay 1978-79,
W83-01268 2H

LIMNOLOGY
Limnology of Opal Lake,
W83-01116 2H

LINEAR PROGRAMMING
Efficiency of Resource Use Under Small-Scale Irrigation Technology in Nigeria,
W83-01083 6B

LITHOLOGIC LOGS
Dynamics of the Foreshore of a Large Aggradational Feature in the Northwestern Black Sea,
W83-01095 2J

LONG-TERM PLANNING
Inflow and Levels of the Caspian Sea and Their Variations Under the Effect of Climatic Factors and Economic Activity,
W83-01094 4A

Expansion Planning of Water Supply Projects in Tegucigalpa, Honduras (Ausbauplanung Von Wasserversorgungsprojekten in Tegucigalpa, Honduras),
W83-01343 6A

LOUISIANA
Accumulation of Plant Nutrients and Heavy Metals Through Sedimentation Processes and Accretion in a Louisiana Salt Marsh,
W83-01125 2L

Time of Travel of Solutes in the Vermilion River, Louisiana,
W83-01189 5B

Drainage Is the Byword in Louisiana Parish.
W83-01348 4A

LYSIMETERS
A Weighing Lysimeter for Use in Isolated Field Areas,
W83-01308 2G

MACROINVERTEBRATES
Effect of Elevated Water Temperature on Macroinvertebrate Communities in Outdoor Experimental Channels,
W83-01195 5C

MAINE
Structural Analysis of Fouling Community Development in the Damariscotta River Estuary, Maine,
W83-01117 2L

Stable Density Fronts and Dinoflagellate Patches in a Tidal Estuary,
W83-01121 2L

Effectiveness of Septic Systems in Safeguarding the Groundwater in Maine,
W83-01278 5G

MAINTENANCE
The Reconstruction of the Schlichem Barrage Near Schomberg in the Zollernalb District (Die Sanierung Der Schlichemtalsperre Bei Schomberg in Zollernalbkreis),
W83-01111 8D

Sliplining Ends Gadsden Infiltration.
W83-01344 5G

Opinion,
W83-01346 5G

MAINTENANCE COSTS
Costs of Preventive Maintenance Programs in Wastewater Collection Systems,
W83-01339 5D

MANGANESE
Statistical Analysis of Estuarine Profiles: Application to Manganese and Ammonium in the Tamar Estuary,
W83-01154 2L

MANGROVE SWAMPS
Tidal Export of Particulate Organic Matter from a Northern Australian Mangrove System,
W83-01124 2L

MAPS
Map of Water Table in Solomon River Valley, Waconda Lake to Solomon, North-Central Kansas, May 1980,
W83-01180 7C

Map of Water Table in Graham County, Northwestern Kansas, March 1979,
W83-01181 7C

Hydrologic Maps of the Ogallala Aquifer, West-Central Kansas, 1979-81,
W83-01188 7C

MARINE SEDIMENTS
Microbial Contamination of Continental Shelf Sediments by Wastewater Sludge,
W83-01214 5B

Pathogenic Amoebae in Ocean Sediments Near Wastewater Sludge Disposal Sites,
W83-01216 5C

MARYLAND
Simulating the Lateral Transport of Ichthyoplankton in the Potomac Estuary,
W83-01136 2L

MASS TRANSFER
Mass Transfer in a Rotating Biological Contractor,
W83-01198 5D

Models of Particle Dry Deposition to a Lake Surface and Some Effects of Surface Microlayers,
W83-01267 5B

MASSACHUSETTS
Use and Limitations of Sedimentary Pigments as Indicators of Past Lake Productivity,
W83-01237 5A

Removal of Humic Substances and Turbidity in Water Supply Sources by Polymer Coagulation and Direct Filtration,
W83-01239 5F

The Septic Tank as a Wastewater Treatment and Disposal Facility,
W83-01241 5D

Planning for Droughts,
W83-01347 6D

MATHEMATICAL EQUATIONS
Mathematical Model for Partially Mixed Estuaries Using the Turbulence Energy Equation,
W83-01133 2L

Dynamic Equations for Steady Spatially Varied Open Channel Flow: A Critical Review,
W83-01395 8B

MATHEMATICAL MODELS
Stochastic Approach to Evaluating the Effectiveness of Reclamation Measures,
W83-01093 6A

Inflow and Levels of the Caspian Sea and Their Variations Under the Effect of Climatic Factors and Economic Activity,
W83-01094 4A

Laboratory Investigation of the Structure of the Flow and Bottom Features in River Mouth Regions,
W83-01099 2E

Surface Layers of Air and Water and their Role in Heat and Moisture Exchange Between a Water Body and the Atmosphere,
W83-01113 2D

Hydrologic Maps of the Ogallala Aquifer, West-Central Kansas, 1979-81,
W83-01188 7C

Mathematical Model for Dissolved Oxygen in Three Southern Ontario Reservoirs,
W83-01227 5B

A Pricing Policy for Groundwater Management in Puerto Rico,
W83-01276 6C

MATHEMATICAL STUDIES
Tensor Structure of the Coefficient of Hydraulic Friction,
W83-01096 8B

Laboratory Investigations of Methods of Protecting Supports from Local Scour,
W83-01098 8B

Laboratory Investigation of the Structure of the Flow and Bottom Features in River Mouth Regions,
W83-01099 2E

Surface Layers of Air and Water and their Role in Heat and Moisture Exchange Between a Water Body and the Atmosphere,
W83-01113 2D

Simple Trophic State Classification of the Canadian Nearshore Waters of the Great Lakes,
W83-01199 5C

MEASURING INSTRUMENTS
Comparative Study and Calibration of Sensors for the Measurement of the Liquid Water Content of Clouds with Small Droplets,
W83-01091 7B

Automated Prevalve Sample Filtration in Flow Injection Analysis: Determination of Sulphate in Water Removing Suspended Solids and Colour Before Sampling,
W83-01303 5A

Continuous Monitoring of Total and Inorganic Mercury in Wastewater and Other Waters,
W83-01380 5A

MELOSIRA
Effects of a Hexachlorobiphenyl and Pentachlorophenol on Growth and Photosynthesis of Phytoplankton,
W83-01242 5C

MEMBRANE PROCESSES
Application of Non-Fouling Ultrafiltration Membranes in Water Conversion Technology,
W83-01277 3A

Isolation and Control of Membrane Filter Degrading Microorganisms,
W83-01359 3A

Development of New Cleaning Techniques for Reverse Osmosis Membranes,
W83-01369 3A

MERCURY
Effect of Microbial Life Stages on the Fate of Methylmercury in Natural Waters,
W83-01104 5B

Time-Dependent Variation of Mercury in a Stream Sediment and the Effect Upon Mercury Content in Gammarus Pulex (L.),
W83-01212 5A

Continuous Monitoring of Total and Inorganic Mercury in Wastewater and Other Waters,
W83-01380 5A

Recent Increase in Mercury Sedimentation in a Forest Lake Attributable to Peatland Drainage,
W83-01393 5B

METALS
The Distribution of Lead, Zinc and Cadmium in Sediments of an Ore-Enriched Lotic Ecosystem, the River Ecclesbourne, Derbyshire,
W83-01073 5B

Control by Alkaline Neutralization of Trace Elements in Acidic Coal Cleaning Waste Leachates,
W83-01075 5G

Relationships Between Organically Bound Cu Mn in Settling Particulate Matter and Biological Processes in a Subarctic Estuary,
W83-01126 2L

Trace Metal Accumulation in Surface Microlayers,
W83-01248 5B

Atmospheric Role in Trace Metal Exchange at the Air-Water Interface,
W83-01255 5B

Modeling Trace Metals in the Surface Microlayer,
W83-01260 5B

METEOROLOGICAL DATA COLLECTION
A Microprocessor Controlled System for Storm Water Sampling (Ein Mikroprozessor-Gesteurtes System Zur Probennahme Aus Regeneasserkanalen),
W83-01342 7A

METHYLMERCURY
Effect of Microbial Life Stages on the Fate of Methylmercury in Natural Waters,
W83-01104 5B

MICHIGAN
Solving a Drainage Ditch Vegetation Problem.
W83-01332 4A

MICROBIAL DEGRADATION
Isolation and Control of Membrane Filter Degrading Microorganisms,
W83-01359 3A

MICROBIOLOGICAL STUDIES
Microbiota in Surface Films: An Historical Perspective,
W83-01245 5B

Refinement of the Identification and Speciation Schemes of Fecal Streptococci,
W83-01365 5A

MICROCYSTIS
Effects of a Hexachlorobiphenyl and Pentachlorophenol on Growth and Photosynthesis of Phytoplankton,
W83-01242 5C

MICROENVIRONMENT
Evaluation of Microcosms for Determining the Fate and Effect of Benz(a)anthracene in Aquatic Systems,
W83-01282 5B

MICROWAVE MEASUREMENT
Snow Stratography and Water Equivalence Measured with an Active Microwave System,
W83-01060 2C

MIDDLE ATLANTIC BIGHT
Microbial Contamination of Continental Shelf Sediments by Wastewater Sludge,
W83-01214 5B

Pathogenic Amoebae in Ocean Sediments Near Wastewater Sludge Disposal Sites,
W83-01216 5C

MIGRATION
Results of Preliminary Experiments on the Influence of Fabrics on the Migration of Groundwater and Water-Soluble Minerals in the Capillary Fringe,
W83-01253 8G

MINE WASTES
Influence of Particle Size Distribution on Water Quality in Agricultural Impoundments,
W83-01280 5B

MINERAL SPRINGS
Fluid-Mineral Equilibria in a Hydrothermal System, Roosevelt Hot Springs, Utah,
W83-01142 2K

MINERALS
Results of Preliminary Experiments on the Influence of Fabrics on the Migration of Groundwater and Water-Soluble Minerals in the Capillary Fringe,
W83-01253 8G

MINING ENGINEERING
The Effects of Mining Southland Lignite on Water and Soil Resources,
W83-01151 6G

MINNESOTA
Water Resources Data, Minnesota, Water Year 1981. Volume 2. Upper Mississippi and Missouri River Basins.
W83-01397 7C

Water Resources Data, Minnesota, Water Year 1981. Volume 1. Great Lakes and Souris-Red-Rainy River Basins.
W83-01398 7C

MISSISSIPPI
Treatment Technology to Meet the Drinking Water Standards for Trihalomethanes for Jackson, Mississippi,
W83-01360 5F

MISSISSIPPI RIVER
Effect of Elevated Water Temperature on Macroinvertebrate Communities in Outdoor Experimental Channels,
W83-01195 5C

MISSOURI
Streamflow and Water-Quality Conditions, Wilsons Creek and James River, Springfield Area, Missouri,
W83-01192 4C

Creation and Operation of the Metropolitan St. Louis Sewer District,
W83-01209 5D

Combined Sewers: Maintaining Yesterday's Infrastructure with Today's Technology,
W83-01211 5D

Influence of Particle Size Distribution on Water Quality in Agricultural Impoundments,
W83-01280 5B

MISSOURI RIVER BASIN
Water Resources Data, Minnesota, Water Year 1981. Volume 2. Upper Mississippi and Missouri River Basins.
W83-01397 7C

MIXING
The Definition and Use of Mixing Zones,
W83-01070 5G

Laboratory Simulation of Chemical Processes Induced by Estuarine Mixing: The Behaviour of Iron and Phosphate in Estuaries,
W83-01120 2L

MODEL STUDIES
Mechanism Governing the Estuarine Circulation in Deep, Strongly Stratified Fjords,
W83-01132 2L

Mathematical Model for Partially Mixed Estuaries Using the Turbulence Energy Equation,
W83-01133 2L

Statistical Analysis of Estuarine Profiles: Application to Manganese and Ammonium in the Tamar Estuary,
W83-01154 2L

Stability Analysis of Water Movement in Unsaturated Porous Materials. I. Theoretical Considerations,
W83-01200 2G

An Alternative Conceptual Model of Groundwater Flow,
W83-01204 2F

Simulation of Long-Term Transient Density-Dependent Transport in Groundwater,
W83-01220 2F

Passage of Floods Over River Floodplains,
W83-01233 2E

Modeling Trace Metals in the Surface Microlayer,
W83-01260 5B

Models of Particle Dry Deposition to a Lake Surface and Some Effects of Surface Microlayers,
W83-01267 5B

An Economic Evaluation of Interbasin Water Transfers: A Case Study of Southwestern Connecticut,
W83-01271 6C

Computer Evaluation of Sprinkler Irrigation Uniformity,
W83-01290 3F

A Field Test of a Conceptual Computer Simulation Model for Predicting Water and Salt Distribution,
W83-01309 2G

A Conceptual Model of Water Transport Through Unsaturated Soil Zone,
W83-01376 2G

Statistical Characteristics of Some Indian Hydrologic Time Series,
W83-01385 2E

Application of Sacramento River Forecast Model to an Indian Catchment,
W83-01386 2A

Application of Deterministic Conceptual Model for Water Balance Studies,
W83-01387 2A

MOISTURE DENSITY
Effects of Artificial Conifer Foliage on Collection of Precipitation and Nutrients in Coastal British Columbia,
W83-01218 2I

MOISTURE GRADIENT
Surface Layers of Air and Water and their Role in Heat and Moisture Exchange Between a Water Body and the Atmosphere,
W83-01113 2D

MOISTURE STRESS
Moisture Stress in Navy Beans. I. Effect of Withholding Irrigation at Different Phenological Stages on Growth and Yield,
W83-01289 3F

MOLLUSKS
Factors Affecting the Distribution of the Bivalve, Macoma Balthica (L.) on a Mudflat Receiving Sewage Effluent, Fraser River Estuary, British Columbia,
W83-01127 5C

MONITORING
Phytoplankton Composition and Distribution as an Expression of Properties of Reservoirs,
W83-01224 2H

Continuous Monitoring of Total and Inorganic Mercury in Wastewater and Other Waters,
W83-01380 5A

MONTANA
Algal Growth Stimulus by Phosphorus in Flathead Lake, Montana, Sediments,
W83-01065 5C

MORPHOLOGY
Laboratory Investigation of the Structure of the Flow and Bottom Features in River Mouth Regions,
W83-01099 2E

MOUNT ST. HELENS
A Pilot Study of Potential Phenolic Contamination of Fishes in the Columbia River and Tributaries in the Vicinity of Mount St. Helens,
W83-01354 5C

MUD
Dynamics of Mud (Slick) and Suspended Matter in Estuaries. Applicability of By-Products of Surveys of German Coastal Agencies in View of Requirements for Future Needs,
W83-01161 2J

MUNICIPAL WASTEWATER
Extractable Organic Matter in Municipal Wastewaters. 2. Hydrocarbons: Molecular Characterization,
W83-01077 5A

Seepage Ponds to Recycle Municipal Wastewater,
W83-01238 5D

Precipitation Treatment of Municipal Wastewater with Added Activated Carbon (Fallungsreinigung Von Kommunalem Abwasser Mit Zusatz Von Aktivkohle),
W83-01307 5D

Experience Report for Decentralized Wastewater Treatment (Erfahrungsbericht Mit Der Dezentralen Abwasserreinigung),
W83-01326 5D

MUNICIPAL WATER
Water Resource Management and Conservation for the Future,
W83-01274 3D

MUSKEG
Watersheds in Muskeg Terrain. 1. The Chemistry of Water Systems,
W83-01206 2K

MUTAGENICITY
2,4,6-Trinitrotoluene-Surfactant Complexes: Decomposition, Mutagenicity, and Soil Leaching Studies,
W83-01067 5B

NARRAGANSETT BAY
Environmental Improvement on Narragansett Bay as a Result of Section 312 Implementation of the Federal Water Pollution Control Act,
W83-01130 5G

Chemical Studies of Copper-Organic Complexes Isolated from Estuarine Waters Using C18 Reverse-Phase Liquid Chromatography,
W83-01139 5A

NAVY BEANS
Moisture Stress in Navy Beans. I. Effect of Withholding Irrigation at Different Phenological Stages on Growth and Yield,
W83-01289 3F

NEARSHORE PROCESSES
Simple Trophic State Classification of the Canadian Nearshore Waters of the Great Lakes,
W83-01199 5C

NEPHELOMETER
On the Use of the Nephelometer in Estuarine Waters,
W83-01135 5A

NETWORK DESIGN
An Operational Key Station Network for the Sone Catchment,
W83-01384 7A

NETWORKS
Correlation Procedures to Reduce Water Losses (Korrelationsverfahren Zur Wasserverlusminderung),
W83-01305 5F

NEUSTON
Bacterionueston Involved in the Oxidation of Hydrocarbons at the Air-Water Interface,
W83-01247 5B

NEW JERSEY
The Development of Phytoplankton Populations and Nutrients in a Tidal River Under Drought Conditions,
W83-01283 5B

NEW MEXICO
Water-Table Map of the San Jose Well Field and Vicinity, Albuquerque, New Mexico, Spring 1981,
W83-01184 7C

Technical Manual for Groundwater Exploration in Arid and Semiarid Regions Using Landsat Visual and Digital Analyses,
W83-01356 7A

Isolation and Control of Membrane Filter Degrading Microorganisms,
W83-01359 3A

NEW ZEALAND
Sedimentation in an Artificial Lake - Lake Matahina, Bay of Plenty,
W83-01084 2J

Zonation of Inshore Benthos off a Sewage Outfall in Hawke Bay, New Zealand,
W83-01085 5C

Limnology of Opal Lake,
W83-01116 2H

Ohiwa Harbour, Natural Values,
W83-01146 6G

Fences for Floodways,
W83-01148 4A

Avon-Heathcote, Estuary Under Stress,
W83-01149 5B

A River Study.
W83-01150 5G

The Effects of Mining Southland Lignite on Water and Soil Resources,
W83-01151 6G

The Estuarine Zone, an Overview,
W83-01163 2L

Government Announces Policy on Wild Rivers,
W83-01164 6E

Tutira, A Lake Worth Restoring,
W83-01165 5G

The National Development Act and Regional Water Boards,
W83-01167 6E

Mahurangi, Problems of Management,
W83-01168 6G

The Te Awa Research: 35 Years of Soil Conservation,
W83-01169 4D

It's all Downhill from Here. The Erewhon Rural Water Supply Scheme,
W83-01170 8A

Wood and Water,
W83-01171 6D

Water to Play With,
W83-01172 6D

Grass Carp and Water Weed,
W83-01173 4A

Manganui-a-te-Ao: The Tug of War River.
W83-01174 6G

The Dying Estuary,
W83-01291 6G

What's in the Water,
W83-01292 5A

A Water Right for Fisheries,
W83-01293 6E

Soil Conservation Protects the Trout,
W83-01294 4D

High Intensity Rainfalls in NZ,
W83-01295 2B

Watching the River's Flow.
W83-01310 5B

Water Demand on the Rakaia,
W83-01315 6D

More or Less Water,
W83-01317 6G

The Onflow of Irrigation Schemes,
W83-01318 3B

NIGERIA
Efficiency of Resource Use Under Small-Scale Irrigation Technology in Nigeria,
W83-01083 6B

NITRATES
Progress Toward a Solution to the Nitrate Problem,
W83-01072 5F

Seepage Ponds to Recycle Municipal Wastewater,
W83-01238 5D

NITRIFICATION
Nitrogen Removal With Rotating Disc System (Stickstoffelimination Mit Dem Tauchtropfkorper),
W83-01323 5D

First Operational Experience at the Wastewater Treatment Facility of the Breisgauer Bucht Wastewater Association (Erste Betriebserfahrungen auf der Klaranlage des Abwasserzweckverbandes Breisgauer Bucht),
W83-01327 5D

NITROGEN
Evaluation of a Persulfate Digestion Method for Particulate Nitrogen and Phosphorus,
W83-01196 5A

Determination of Total Kjeldahl Nitrogen and Total Phosphorus in Surface Waters and Wastewaters,
W83-01210 5A

Environmental Factors Promoting and Regulating N2 Fixing Blue-Green Algal Blooms in the Chowan River, NC,
W83-01357 5C

NITROGEN COMPOUNDS
The Influence of Atmospheric Nitrogen Influx Upon the Stream Nitrogen Profile of a Relatively Undisturbed Forested Watershed,
W83-01059 5B

NITROGEN FIXING BACTERIA
Environmental Factors Promoting and Regulating N2 Fixing Blue-Green Algal Blooms in the Chowan River, NC,
W83-01357 5C

NITROGEN REMOVAL
Nitrogen Removal With Rotating Disc System (Stickstoffelimination Mit Dem Tauchtropfkorper),
W83-01323 5D

Nitrogen Removal by Means of Preliminary Denitrification (Stickstoffelimination Durch Vorgeschaltete Denitrifikation),
W83-01324 5D

NORTH CAROLINA
Environmental Factors Promoting and Regulating N2 Fixing Blue-Green Algal Blooms in the Chowan River, NC,
W83-01357 5C

An Investigation of Psychological Components of Water Conservation Behavior,
W83-01363 3D

NORWAY
Sediment Fans and Sediment Flows Generated by Snowmelt: Observations at Austerdalsisen, Norway,
W83-01254 2J

NUCLEAR POWERPLANTS
Thermophillic and Thermotolerant Fungi Isolated from the Thermal Effluent of Nuclear Power Generating Reactors: Dispersal of Human Opportunistic and Veterinary Pathogenic Fungi,
W83-01375 5C

NUTRIENTS
Accumulation of Plant Nutrients and Heavy Metals Through Sedimentation Processes and Accretion in a Louisiana Salt Marsh,
W83-01125 2L

Nutrient Enrichment of Seagrass Beds in a Rhode Island Coastal Lagoon,
W83-01129 5C

Evaluation of a Persulfate Digestion Method for Particulate Nitrogen and Phosphorus,
W83-01196 5A

Simple Trophic State Classification of the Canadian Nearshore Waters of the Great Lakes,
W83-01199 5C

Effects of Artificial Conifer Foliage on Collection of Precipitation and Nutrients in Coastal British Columbia,
W83-01218 2I

Potential Eutrophication of the Rideau River by an Urban Waterway: Discussion,
W83-01219 5C

Patterns of Circulation and Nutrient Supply in a Medium Residence-Time Reservoir Kootenay Lake, British Columbia,
W83-01223 2H

The Development of Phytoplankton Populations and Nutrients in a Tidal River Under Drought Conditions,
W83-01283 5B

OKLAHOMA
Path Analysis of a Reservoir Ecosystem Model,
W83-01228 6G

OLIGOTROPHIC LAKES
Algal Growth Stimulus by Phosphorus in Flathead Lake, Montana, Sediments,
W83-01065 5C

ON-SITE DATA COLLECTIONS
Water-Quality and Hydrogeologic Data for Three Phosphate Industry Waste-Disposal Sites in Central Florida, 1979-80,
W83-01190 7C

ON-SITE TREATMENT
Evaluation of the Use of Iodine for Disinfection of Effluent from On-Site 'Package' Wastewater Treatment Systems,
W83-01361 5D

Design Considerations for Use of On-Site Sand Filters for Wastewater Treatment,
W83-01368 5D

ONTARIO
Deposition and Chemistry of Pollutant Metals in Lakes Around the Smelters at Sudbury, Ontario,
W83-01078 5B

ONTARIO

An Analysis of Factors Influencing De-Icing Salt Levels in Streams,
W83-01088 5B

Effect of Microbial Life Stages on the Fate of Methylmercury in Natural Waters,
W83-01104 5B

Potential Eutrophication of the Rideau River by an Urban Waterway: Discussion,
W83-01219 5C

Mathematical Model for Dissolved Oxygen in Three Southern Ontario Reservoirs,
W83-01227 5B

Density-Driven Interstitial Water Motion in Sediments,
W83-01372 2H

OPEN-CHANNEL FLOW
Dynamic Equations for Steady Spatially Varied Open Channel Flow: A Critical Review,
W83-01395 8B

OREGON
Stochastic Predictions of Sediment Yields from Small Coastal Watersheds in Oregon, U.S.A.,
W83-01053 2J

210Pb Geochronology and Trace Metal Concentrations of Sediments from Upper Klamath Lake and Lake Euwana, Oregon,
W83-01252 2J

ORGANIC COMPOUNDS
Organic Contaminants in Groundwater Near an Underground Coal Gasification Site in Northeastern Wyoming,
W83-01066 5B

Equilibrium Distribution Coefficients for Extraction of Chlorinated Hydrocarbons and Aromatics from Water into Undecane,
W83-01076 5D

Extractable Organic Matter in Municipal Wastewaters. 2. Hydrocarbons: Molecular Characterization,
W83-01077 5A

Effects of Surface Films on Air-Water Exchange Rates,
W83-01262 5C

Fractionation of Hydrophobic Origin Materials in Surface Microlayers,
W83-01266 5B

Quantitative Determination of Volatile Halogenated Hydrocarbons in Water Samples by Capillary Gas Chromatography and Electron Capture Detection,
W83-01338 5A

ORGANIC ENRICHMENT
The Development of Phytoplankton Populations and Nutrients in a Tidal River Under Drought Conditions,
W83-01283 5B

ORGANIC MATTER
The Loch Eil Project: Assessment and Synthesis with a Discussion of Certain Biological Questions Arising from a Study of the Organic Pollution of Sediments,
W83-01086 5C

The Loch Eil Project: Planktonic Pigments in Sediments From Loch Eil and the Firth of Lorne,
W83-01087 5C

Decolorization of Infiltration Water Under Natural Conditions,
W83-01097 2F

Influence of pH on the Fluorescence of Dissolved Organic Matter,
W83-01128 2L

Chemical Studies of Copper-Organic Complexes Isolated from Estuarine Waters Using C18 Reverse-Phase Liquid Chromatography,
W83-01139 5A

Time-Dependent Variation of Mercury in a Stream Sediment and the Effect Upon Mercury Content in Gammarus Pulex (L.),
W83-01212 5A

Short Cycling of Contaminants by Zooplankton and Their Impact on Great Lakes Ecosystems,
W83-01263 5B

Mobilization of Copper from Modified Peat by Dissolved Organic Matter in Natural Waters and Biologically Purified Wastewaters,
W83-01341 5B

Recent Increase in Mercury Sedimentation in a Forest Lake Attributable to Peatland Drainage,
W83-01393 5B

ORGANIC WASTES
Dynamic Simulator for Anaerobic Digestion Processes,
W83-01105 5D

ORGANOPHOSPHORUS PESTICIDES
A Study of Well Water in Selected California Communities for Residues of 1,3-Dichloropropene, Chloroallyl Alcohol and 49 Organophosphate or Chlorinated Hydrocarbon Pesticides,
W83-01396 5B

OROGRAPHIC PRECIPITATION
Radar and Raingauge Observations of Orographic Rain over South Wales,
W83-01061 2B

OSMOSIS
Chemical Osmosis, Reverse Chemical Osmosis, and the Origin of Subsurface Brines,
W83-01143 2K

OSMOTIC PRESSURE
Chemical Osmosis, Reverse Chemical Osmosis, and the Origin of Subsurface Brines,
W83-01143 2K

OTTAWA RIVER
Effect of Microbial Life Stages on the Fate of Methylmercury in Natural Waters,
W83-01104 5B

OUTFALL SEWERS
Zonation of Inshore Benthos off a Sewage Outfall in Hawke Bay, New Zealand,
W83-01085 5C

OUTFALLS
The Definition and Use of Mixing Zones,
W83-01070 5G

OXIDATION-REDUCTION POTENTIAL
Interpretation of pH and Eh Trends in a Fluvial-Sand Aquifer System,
W83-01201 2K

OXYGEN DEMAND
Usefulness of Sediment Oxygen as a Tool for Impoundment Management,
W83-01371 5B

OXYGEN REQUIREMENTS
Deep Water Renewals and Oxygen Consumption in an Alaskan Fjord,
W83-01119 2L

OXYGEN SAG
Usefulness of Sediment Oxygen as a Tool for Impoundment Management,
W83-01371 5B

OXYGEN UPTAKE
Alpha and Beta Factors for Domestic Wastewater,
W83-01207 5D

OZONATION
The U.S.: Rethinking Filtration and Disinfection,
W83-01331 5F

PARTICLE SIZE
The Hydrogeology of Alluvial Aquifers in or Bordering the Dissected Till Plains,
W83-01269 2F

PARTICLE SIZE DISTRIBUTION
Influence of Particle Size Distribution on Water Quality in Agricultural Impoundments,
W83-01280 5B

PARTICULATE MATTER
Tidal Export of Particulate Organic Matter from a Northern Australian Mangrove System,
W83-01124 2L

Relationships Between Organically Bound Cu Mn in Settling Particulate Matter and Biological Processes in a Subarctic Estuary,
W83-01126 2L

PARTITION COEFFICIENTS
Pesticide Partitioning in Artificial Surface Films,
W83-01256 5B

PATH ANALYSIS
Path Analysis of a Reservoir Ecosystem Model,
W83-01228 6G

PATH OF POLLUTANTS
Distributions of Heavy Metals in Bottom Mud and Polygonum Nodosum in the Watarase River (In Japanese),
W83-01175 5B

Time of Travel of Solutes in the Vermilion River, Louisiana,
W83-01189 5B

Acid Deposition,
W83-01217 5C

PATHOGENIC BACTERIA
In Situ Survival of Enteric Bacteria in Estuarine Environments of Different Nutrient Characteristics,
W83-01281 2L

PENNSYLVANIA
Ground-Water Quality and Data on Wells and Springs in Pennsylvania, Volume III--Delaware River Basin,
W83-01185 7C

Ground-Water Quality and Data on Wells and Springs in Pennsylvania, Volume II--Susquehanna and Potomac River Basins,
W83-01186 7C

Chemical Interactions Between Forest Soils and Acidic Precipitation During a Dormant Season on Wildcat Run Watershed in Southwestern Pennsylvania,
W83-01236 2K

Design Considerations for Use of On-Site Sand Filters for Wastewater Treatment,
W83-01368 5D

PENTACHLOROPHENOL
A Pilot Study of Potential Phenolic Contamination of Fishes in the Columbia River and Tributaries in the Vicinity of Mount St. Helens,
W83-01354 5C

PERMEABILITY COEFFICIENT
The Hydrogeology of Alluvial Aquifers in or Bordering the Dissected Till Plains,
W83-01269 2F

PERSULFATES
Evaluation of a Persulfate Digestion Method for Particulate Nitrogen and Phosphorus,
W83-01196 5A

PESTICIDE KINETICS
Effects of Water on the Fate of Herbicides in Irrigated Soils,
W83-01355 5B

PESTICIDE RESIDUES
A Study of Well Water in Selected California Communities for Residues of 1,3-Dichloropropene, Chloroallyl Alcohol and 49 Organophosphate or Chlorinated Hydrocarbon Pesticides,
W83-01396 5B

PESTICIDES
Mass Balance Modeling of DDT Dynamics in Lakes Michigan and Superior,
W83-01069 5B

Pesticide Partitioning in Artificial Surface Films,
W83-01256 5B

PHENOLS
Effects of a Hexachlorobiphenyl and Pentachlorophenol on Growth and Photosynthesis of Phytoplankton,
W83-01242 5C

Sorption of Phenol by Chemically Treated Flyash,
W83-01296 5D

A Pilot Study of Potential Phenolic Contamination of Fishes in the Columbia River and Tributaries in the Vicinity of Mount St. Helens,
W83-01354 5C

PHOSPHATE
Laboratory Simulation of Chemical Processes Induced by Estuarine Mixing: The Behaviour of Iron and Phosphate in Estuaries,
W83-01120 2L

PHOSPHATES
Water-Quality and Hydrogeologic Data for Three Phosphate Industry Waste-Disposal Sites in Central Florida, 1979-80,
W83-01190 7C

Weak-Electrolyte Ion Exchange in Advanced-Technology Water-Reuse Systems,
W83-01275 5D

PHOSPHORUS
Algal Growth Stimulus by Phosphorus in Flathead Lake, Montana, Sediments,
W83-01065 5C

Anionic Surfactant Concentration in the River and Sea Waters of Hyogo Pref. and its Relationship to Phosphorus Concentration, (In Japanese),
W83-01152 5B

Evaluation of a Persulfate Digestion Method for Particulate Nitrogen and Phosphorus,
W83-01196 5A

Simple Trophic State Classification of the Canadian Nearshore Waters of the Great Lakes,
W83-01199 5C

Determination of Total Kjeldahl Nitrogen and Total Phosphorus in Surface Waters and Wastewaters,
W83-01210 5A

Recent Investigations on the Eutrophication and Restoration of Lake Constance (Neuere Untersuchungen Uber Die Eutrophierung Und Sanierung Des Bodensees),
W83-01321 5G

Causes, Prevention and Control of Bulking Sludge in Activated Sludge Plants (Ursachen, Verhinderung Und Bekampfung Der Blahschlammbildung in Belebungsanlagen),
W83-01325 5D

Environmental Factors Promoting and Regulating N2 Fixing Blue-Green Algal Blooms in the Chowan River, NC,
W83-01357 5C

PHOSPHORUS REMOVAL
Water Quality Assurance by Phosphorus Reduction in Drinking Water Reservoirs (Sicherung Der Trinkwassergute Als Folge Von Phosphoreliminierungsmassnahmen and Trinkwassertalsperren),
W83-01114 5F

PHOTOLYSIS
Photolysis of Hexachlorocyclopentadiene in Water,
W83-01079 5B

PHOTOSYNTHESIS
Effects of a Hexachlorobiphenyl and Pentachlorophenol on Growth and Photosynthesis of Phytoplankton,
W83-01242 5C

PHYTOPLANKTON
Phytoplankton Composition and Distribution as an Expression of Properties of Reservoirs,
W83-01224 2H

Effects of a Hexachlorobiphenyl and Pentachlorophenol on Growth and Photosynthesis of Phytoplankton,
W83-01242 5C

Overview of Phytoplankton Contaminant Problems,
W83-01243 5B

Field and Laboratory Studies of the Toxicity of Phytoplankton of Polychlorinated Biphenyls (PCBs) Desorbed from Fine Clays and Natural Suspended Particulates,
W83-01244 5C

The Development of Phytoplankton Populations and Nutrients in a Tidal River Under Drought Conditions,
W83-01283 5B

PIEZOMETERS
Measuring Station to Determine Pore Water Pressure - Zervreila Arch Dam (Messanlage Fur Porenwasserduck - Bogenstaumauer Zervreila),
W83-01100 8G

PIPELINES
Correlation Procedures to Reduce Water Losses (Korrelationsverfahren Zur Wasserverlusminderung),
W83-01305 5F

More Water for Texas Coastal Plains.
W83-01333 8A

Egham Expansion Provides Bulk Water Supply.
W83-01335 5F

PIPES
Modified Graphical Determination of Submain Size,
W83-01101 8C

Critical Water Supply Restored: CH2M Hill Called to Rescue of Collapsed Irrigation Canal.
W83-01316 8G

PLANKTON
Limnology of Mt. Elbert Forebay 1978-79,
W83-01268 2H

PLANNING
Water to Play With,
W83-01172 6D

Manganui-a-te-Ao: The Tug of War River.
W83-01174 6G

Water Demand on the Rakaia,
W83-01315 6D

Planning for Droughts,
W83-01347 6D

PLANNNG
Preventing Erosion, Landslip and Flooding, A Planning Approach,
W83-01147 6F

PLANT PIGMENTS
The Loch Eil Project: Planktonic Pigments in Sediments From Loch Eil and the Firth of Lorne,
W83-01087 5C

PODZOLS
Decolorization of Infiltration Water Under Natural Conditions,
W83-01097 2F

POLAR REGIONS
High Abundance of Algal 24-Ethylcholesterol in Antarctic Lake Sediment,
W83-01373 2H

POLICY MAKING
Government Announces Policy on Wild Rivers,
W83-01164 6E

POLLUTANT IDENTIFICATION
On the Use of the Nephelometer in Estuarine Waters,
W83-01135 5A

Chemical Studies of Copper-Organic Complexes Isolated from Estuarine Waters Using C18 Reverse-Phase Liquid Chromatography,
W83-01139 5A

Quantitative Determination of Volatile Halogenated Hydrocarbons in Water Samples by Capillary Gas Chromatography and Electron Capture Detection,
W83-01338 5A

Refinement of the Identification and Speciation Schemes of Fecal Streptococci,
W83-01365 5A

A Study of Well Water in Selected California Communities for Residues of 1,3-Dichloropropene, Chloroallyl Alcohol and 49 Organophosphate or Chlorinated Hydrocarbon Pesticides,
W83-01396 5B

POLLUTION IDENTIFICATION
Determination of Total Kjeldahl Nitrogen and Total Phosphorus in Surface Waters and Wastewaters,
W83-01210 5A

POLYCHLORINATED BIPHENYLS
Fate of Polychlorinated Biphenyls (PCBs) in Soil Plant Systems,
W83-01235 5B

Overview of Phytoplankton Contaminant Problems,
W83-01243 5B

Field and Laboratory Studies of the Toxicity of Phytoplankton of Polychlorinated Biphenyls (PCBs) Desorbed from Fine Clays and Natural Suspended Particulates,
W83-01244 5C

Enrichment of PCBs in Lake Michigan Surface Films,
W83-01259 5B

Short Cycling of Contaminants by Zooplankton and Their Impact on Great Lakes Ecosystems,
W83-01263 5B

POLYCHLORINATED BIPHENYLS

Reversible and Resistant Components of PCB Adsorption-Desorption: Adsorbent Concentration Effects,
W83-01264 5B

Accumulation of the Polychlorinated Biphenyl Aroclor 1242 from Contaminated Detritus and Water by the Saltmarsh Detritivore, UCA Pugnax,
W83-01394 5B

POLYMERS
Removal of Humic Substances and Turbidity in Water Supply Sources by Polymer Coagulation and Direct Filtration,
W83-01239 5F

POPULATION DENSITY
Chrysophyceae from Some Greek Lakes,
W83-01064 5C

POPULATION DYNAMICS
Effect of Elevated Water Temperature on Macroinvertebrate Communities in Outdoor Experimental Channels,
W83-01195 5C

PORE PRESSURE
Measuring Station to Determine Pore Water Pressure - Zervreila Arch Dam (Messanlage Fur Porenwasserduck - Bogenstaumauer Zervreila),
W83-01100 8G

POROUS MEDIA
Similarity Solutions of the Porous Media Equation,
W83-01058 2F

Stability Analysis of Water Movement in Unsaturated Porous Materials. I. Theoretical Considerations,
W83-01200 2G

POTABLE WATER
Dam Kleine Kinzig - Design and Construction (Talsperre Kleine Kinzig - Entwurf Und Ausfuhrung),
W83-01110 8D

Construction of the Dam to Supply Potable Water on the 'Kleine Kinzig' River Near Freudenstadt (Bauablauf an Der Trinkwassertalsperre Kleine Kinzig Bei Freudenstadt),
W83-01112 8D

POTAMOGETON
Enrichment of Copper, Zinc, Manganese, and Iron in Five Species of Pondweeks (Potamogeton Spp.),
W83-01392 5B

POTOMAC ESTUARY
Simulating the Lateral Transport of Ichthyoplankton in the Potomac Estuary,
W83-01136 2L

PRECIPITATION
Precipitation Data for Burial Grounds 5 and 6, Oak Ridge National Laboratory, Tennessee, 1976-1980,
W83-01183 7C

PRECIPITATION TREATMENT
Precipitation Treatment of Municipal Wastewater with Added Activated Carbon (Fallungsreinigung Von Kommunalem Abwasser Mit Zusatz Von Aktivkohle),
W83-01307 5D

PREDICTION
Predicting Cavitation in Tunnel Spillways,
W83-01285 8B

High Intensity Rainfalls in NZ,
W83-01295 2B

PRESSURE CONDUITS
Characteristics of a Low-Head Pressure Conduit,
W83-01286 8B

PRESSURE HEAD
Characteristics of a Low-Head Pressure Conduit,
W83-01286 8B

PRESSURE-MEASURING INSTRUMENTS
Measuring Station to Determine Pore Water Pressure - Zervreila Arch Dam (Messanlage Fur Porenwasserduck - Bogenstaumauer Zervreila),
W83-01100 8G

PRICING
A Pricing Policy for Groundwater Management in Puerto Rico,
W83-01276 6C

Setting Equitable Water Rates,
W83-01330 6C

PRIMARY PRODUCTIVITY
Primary Production in a Turbid Estuary,
W83-01155 2L

PRIORITIES
Network Model for Optimal Management of Stream-Aquifer Systems,
W83-01366 4B

PRODUCTIVITY
Energy Flow in the Ythan Estuary, Aberdeenshire, Scotland,
W83-01122 2L

PUBLIC HEALTH
Epidemiology of Eltor Cholera in Rural Bangladesh: Importance of Surface Water in Transmission,
W83-01107 5C

Presence of Enteric Microorganisms in the Air Environment at Wastewater Treatment Plants in Puerto Rico,
W83-01272 5D

Acute Fluoride Poisoning Associated with an On-Site Fluoridator in a Vermont Elementary School,
W83-01329 5C

PUBLIC HEALTH CODE
The Septic Tank as a Wastewater Treatment and Disposal Facility,
W83-01241 5D

PUBLIC OPINION
Water Resource Management and Conservation for the Future,
W83-01274 3D

PUERTO RICO
Presence of Enteric Microorganisms in the Air Environment at Wastewater Treatment Plants in Puerto Rico,
W83-01272 5D

A Pricing Policy for Groundwater Management in Puerto Rico,
W83-01276 6C

PULP AND PAPER INDUSTRY
New Aeration System Cuts Waste Treatment Costs at Badger Paper,
W83-01062 5D

The Loch Eil Project: Assessment and Synthesis with a Discussion of Certain Biological Questions Arising from a Study of the Organic Pollution of Sediments,
W83-01086 5C

The Loch Eil Project: Planktonic Pigments in Sediments From Loch Eil and the Firth of Lorne,
W83-01087 5C

PULP WASTES
Environmental Factors Promoting and Regulating N2 Fixing Blue-Green Algal Blooms in the Chowan River, NC,
W83-01357 5C

PUMPED STORAGE
Limnology of Mt. Elbert Forebay 1978-79,
W83-01268 2H

PUMPING
A Pricing Policy for Groundwater Management in Puerto Rico,
W83-01276 6C

PUMPING STATIONS
Egham Expansion Provides Bulk Water Supply.
W83-01335 5F

RADAR
Radar and Raingauge Observations of Orographic Rain over South Wales,
W83-01061 2B

RADIOCESIUM
The Deposition of Windscale Radiocaesium in the Wyre Estuary and the Measurement of Sedimentation Rates,
W83-01138 5B

RADIONUCLIDES
Uranium, Thorium and Lead Nuclides in a Delaware Salt Marsh Sediment,
W83-01123 5B

An Improved Method of Determining Sedimentation Rates by the Use of Artificial Radionuclides,
W83-01153 2J

RADIUM
Ground Water Geochemistry of 228Ra, 226Ra, and 222Rn,
W83-01157 5A

RADON
Ground Water Geochemistry of 228Ra, 226Ra, and 222Rn,
W83-01157 5A

RAIN
Raindrop Axial Ratios,
W83-01092 2B

RAIN GAGES
Radar and Raingauge Observations of Orographic Rain over South Wales,
W83-01061 2B

Rainfall Variation Analysis and Optimization of Gaging Systems,
W83-01202 2B

RAINFALL
Rainfall Variation Analysis and Optimization of Gaging Systems,
W83-01202 2B

A Microprocessor Controlled System for Storm Water Sampling (Ein Mikroprozessor-Gesteurtes System Zur Probennahme Aus Regeneasserkanalen),
W83-01342 7A

Diurnal Variation of Rainfall in the Upper Catchments of North Bengal Rivers,
W83-01377 2B

An Operational Key Station Network for the Sone Catchment,
W83-01384 7A

RAINFALL DISTRIBUTION
Rainfall Variation Analysis and Optimization of Gaging Systems,
W83-01202 2B

RAINFALL INTENSITY
High Intensity Rainfalls in NZ,
W83-01295 2B

RAINFALL RATE
Variation of Trace Element Concentration in Rainwater with Rainfall Rate and Rainfall Amount,
W83-01379 5A

RAINFALL SIMULATOR
Conservation Tillage Effects on Water Conservation,
W83-01240 3F

RAINWATER
Variation of Trace Element Concentration in Rainwater with Rainfall Rate and Rainfall Amount,
W83-01379 5A

RECREATION
Stream Water Quality in a Small Commercial Campground in Colorado,
W83-01090 5B

A River Study.
W83-01150 5G

Government Announces Policy on Wild Rivers,
W83-01164 6E

RECREATION DEMAND
Water to Play With,
W83-01172 6D

RECREATION WASTES
The Effects of Recreation on Freshwater Plants and Animals: A Review,
W83-01390 5C

REGIONAL DEVELOPMENT
Modernizing Irrigation Systems in Alberta,
W83-01232 4A

REGRESSION ANALYSIS
An Improved Method of Determining Sedimentation Rates by the Use of Artificial Radionuclides,
W83-01153 2J

REGULATIONS
Environmental Improvement on Narragansett Bay as a Result of Section 312 Implementation of the Federal Water Pollution Control Act,
W83-01130 5G

Water Regulations,
W83-01144 6E

The National Development Act and Regional Water Boards,
W83-01167 6E

REHABILITATION
Combined Sewers: Maintaining Yesterday's Infrastructure with Today's Technology,
W83-01211 5D

REMOTE SENSING
Technical Manual for Groundwater Exploration in Arid and Semiarid Regions Using Landsat Visual and Digital Analyses,
W83-01356 7A

RESERVOIRS
Water Quality Assurance by Phosphorus Reduction in Drinking Water Reservoirs (Sicherung Der Trinkwassergute Als Folge Von Phosphoreliminierungsmassnahmen and Trinkwassertalsperren),
W83-01114 5F

The Establishment of Water Quality Gradients in Reservoirs,
W83-01222 5B

Patterns of Circulation and Nutrient Supply in a Medium Residence-Time Reservoir Kootenay Lake, British Columbia,
W83-01223 2H

Phytoplankton Composition and Distribution as an Expression of Properties of Reservoirs,
W83-01224 2H

Some Observations on the Ecology and Fish Management of Reservoirs in the United States,
W83-01225 6G

Water Renewal Effects on Reservoir Zooplankton Communities,
W83-01226 2H

Mathematical Model for Dissolved Oxygen in Three Southern Ontario Reservoirs,
W83-01227 5B

Path Analysis of a Reservoir Ecosystem Model,
W83-01228 6G

Simulation of Fish Movements in a Large Hydro-Electric Reservoir: LG-2,
W83-01229 6G

Spatial Variations in Abundance of Phytoplankton, Zooplankton, and Larval Fishes in Center Hill Reservoir,
W83-01230 2H

Limnology of Mt. Elbert Forebay 1978-79,
W83-01268 2H

More Water for Texas Coastal Plains.
W83-01333 8A

RESINS
Weak-Electrolyte Ion Exchange in Advanced-Technology Water-Reuse Systems,
W83-01275 5D

RESOURCES DEVELOPMENT
Water Transfer Strategy: Energy Vs. Agricultural Use,
W83-01358 6B

REVERSE OSMOSIS
Chemical Osmosis, Reverse Chemical Osmosis, and the Origin of Subsurface Brines,
W83-01143 2K

Evaluation of Desalination Technology for Wastewater Reuse.
W83-01270 5D

Development of a 100,000 GPD Brackish Water Module,
W83-01352 3A

Isolation and Control of Membrane Filter Degrading Microorganisms,
W83-01359 3A

Development of New Cleaning Techniques for Reverse Osmosis Membranes,
W83-01369 3A

REVIEWS
Dynamics of Mud (Slick) and Suspended Matter in Estuaries. Applicability of By-Products of Surveys of German Coastal Agencies in View of Requirements for Future Needs,
W83-01161 2J

The Effects of Recreation on Freshwater Plants and Animals: A Review,
W83-01390 5C

Dynamic Equations for Steady Spatially Varied Open Channel Flow: A Critical Review,
W83-01395 8B

RHODE ISLAND
Nutrient Enrichment of Seagrass Beds in a Rhode Island Coastal Lagoon,
W83-01129 5C

Environmental Improvement on Narragansett Bay as a Result of Section 312 Implementation of the Federal Water Pollution Control Act,
W83-01130 5G

Chemical Studies of Copper-Organic Complexes Isolated from Estuarine Waters Using C18 Reverse-Phase Liquid Chromatography,
W83-01139 5A

RHODOPHYTA
Freshwater Red Algae A New Addition to the Iraqi Flora,
W83-01322 2H

RIPARIAN RIGHTS
Federal Common Law and its Application to Disputes Involving Accretive and Avulsive Changes in the Bounds of Navigable Waters,
W83-01160 6E

RIVER FLOW
Statistical Characteristics of Some Indian Hydrologic Time Series,
W83-01385 2E

RIVER FORECASTING
Application of Sacramento River Forecast Model to an Indian Catchment,
W83-01386 2A

RIVER MOUTH
Laboratory Investigation of the Structure of the Flow and Bottom Features in River Mouth Regions,
W83-01099 2E

RIVERS
Analysis of Freeze-Up Ice Jams on the Peace River Near Taylor, British Columbia,
W83-01103 2C

A River Study.
W83-01150 5G

Government Announces Policy on Wild Rivers,
W83-01164 6E

Adsorption and Desorption of Heavy Metals in Bottom Mud of Urban Rivers,
W83-01194 5B

Potential Eutrophication of the Rideau River by an Urban Waterway: Discussion,
W83-01219 5C

The Dynamics of a River Bend: A Study in Flow and Sedimentary Processes,
W83-01249 2E

Watching the River's Flow.
W83-01310 5B

Major Ion Chemistry of Some Large Chinese Rivers,
W83-01374 2K

ROADS
An Analysis of Factors Influencing De-Icing Salt Levels in Streams,
W83-01088 5B

ROCKFILL DAMS
Dam Kleine Kinzig - Design and Construction (Talsperre Kleine Kinzig - Entwurf Und Ausfuhrung),
W83-01110 8D

The Reconstruction of the Schlichem Barrage Near Schomberg in the Zollernalb District (Die Sanierung Der Schlichemtalsperre Bei Schomberg in Zollernalbkreis),
W83-01111 8D

Construction of the Dam to Supply Potable Water on the 'Kleine Kinzig' River Near Freudenstadt (Bauablauf an Der Trinkwassertalsperre Kleine Kinzig Bei Freudenstadt),
W83-01112 8D

ROTATING BIOLOGICAL CONTRACTOR
Mass Transfer in a Rotating Biological Contractor,
W83-01198 5D

ROTATING DISC SYSTEM
Nitrogen Removal With Rotating Disc System (Stickstoffelimination Mit Dem Tauchtropfkorper),
W83-01323 5D

ROUGHNESS COEFFICIENT
Tensor Structure of the Coefficient of Hydraulic Friction,
W83-01096 8B

RUNOFF
Passage of Floods Over River Floodplains,
W83-01233 2E

SACRAMENTO RIVER FORECAST MODEL
Application of Sacramento River Forecast Model to an Indian Catchment,
W83-01386 2A

SAGINAW BAY
Reversible and Resistant Components of PCB Adsorption-Desorption: Adsorbent Concentration Effects,
W83-01264 5B

SALINE-FRESHWATER INTERFACES
An Assessment of the Importance of Some Parameters for Seawater Intrusion in Aquifers and a Comparison of Dispersive and Sharp-Interface Modelling Approaches,
W83-01051 2F

SALINE WATER INTRUSION
An Assessment of the Importance of Some Parameters for Seawater Intrusion in Aquifers and a Comparison of Dispersive and Sharp-Interface Modelling Approaches,
W83-01051 2F

Saline Ground-Water Discharge to the Smoky Hill River Between Salina and Abilene, Central Kansas,
W83-01191 5G

SALINITY
Mathematical Model for Partially Mixed Estuaries Using the Turbulence Energy Equation,
W83-01133 2L

A Field Test of a Conceptual Computer Simulation Model for Predicting Water and Salt Distribution,
W83-01309 2G

Environmental Factors Promoting and Regulating N2 Fixing Blue-Green Algal Blooms in the Chowan River, NC,
W83-01357 5C

SALMONELLA SPP
In Situ Survival of Enteric Bacteria in Estuarine Environments of Different Nutrient Characteristics,
W83-01281 2L

SALT MARSHES
Uranium, Thorium and Lead Nuclides in a Delaware Salt Marsh Sediment,
W83-01123 5B

Accumulation of Plant Nutrients and Heavy Metals Through Sedimentation Processes and Accretion in a Louisiana Salt Marsh,
W83-01125 2L

SALTS
An Analysis of Factors Influencing De-Icing Salt Levels in Streams,
W83-01088 5B

SAMPLE PRESERVATION
Effect of Container Type on pH and Alkalinity Stability,
W83-01197 5A

SAMPLING
On the Use of the Nephelometer in Estuarine Waters,
W83-01135 5A

SAND FILTERS
An Investigation into the Removal of Algae by Fine Sand/Silt Filtration,
W83-01367 5D

Design Considerations for Use of On-Site Sand Filters for Wastewater Treatment,
W83-01368 5D

SATELLITE TECHNOLOGY
Technical Manual for Groundwater Exploration in Arid and Semiarid Regions Using Landsat Visual and Digital Analyses,
W83-01356 7A

SAUDI ARABIA
Heavy Metal Concentrations in Shrimp, Crab, and Sediment Obtained from Ad-Dammam Sewage Outfall Area,
W83-01391 5B

SCENEDESMUS
An Investigation into the Removal of Algae by Fine Sand/Silt Filtration,
W83-01367 5D

SCHEDULING
Scheduling Irrigation by Computer,
W83-01166 3F

SCOTLAND
The Loch Eil Project: Assessment and Synthesis with a Discussion of Certain Biological Questions Arising from a Study of the Organic Pollution of Sediments,
W83-01086 5C

The Loch Eil Project: Planktonic Pigments in Sediments From Loch Eil and the Firth of Lorne,
W83-01087 5C

Energy Flow in the Ythan Estuary, Aberdeenshire, Scotland,
W83-01122 2L

The Dynamics of a River Bend: A Study in Flow and Sedimentary Processes,
W83-01249 2E

Operational Experiences with a Pulsator Clarifier Treating a Coloured Upland Water,
W83-01302 5F

SCOUR
Laboratory Investigations of Methods of Protecting Supports from Local Scour,
W83-01098 8B

SCREENS
Hydrotec - A Geotextile Water Well Screen,
W83-01345 5F

SEA GRASSES
Nutrient Enrichment of Seagrass Beds in a Rhode Island Coastal Lagoon,
W83-01129 5C

SEA LEVEL
Low-Frequency Variations in Sea Level and Currents in South San Francisco Bay,
W83-01057 2L

Inflow and Levels of the Caspian Sea and Their Variations Under the Effect of Climatic Factors and Economic Activity,
W83-01094 4A

SEAWATER
Chemical Model of Caspian Sea Water,
W83-01251 2K

SEDIMENT LOAD
Dynamics of the Foreshore of a Large Aggradational Feature in the Northwestern Black Sea,
W83-01095 2J

SEDIMENT MEASUREMENT
Influence of Particle Size Distribution on Water Quality in Agricultural Impoundments,
W83-01280 5B

SEDIMENT OXYGEN DEMAND
Usefulness of Sediment Oxygen as a Tool for Impoundment Management,
W83-01371 5B

SEDIMENT TRANSPORT
Stochastic Predictions of Sediment Yields from Small Coastal Watersheds in Oregon, U.S.A.,
W83-01053 2J

Dynamics of the Foreshore of a Large Aggradational Feature in the Northwestern Black Sea,
W83-01095 2J

Erosion, Redeposition, and Delivery of Sediment to Midwestern Streams,
W83-01203 4D

SEDIMENT-WATER INTERFACES
Usefulness of Sediment Oxygen as a Tool for Impoundment Management,
W83-01371 5B

SEDIMENT YIELD
Stochastic Predictions of Sediment Yields from Small Coastal Watersheds in Oregon, U.S.A.,
W83-01053 2J

SEDIMENTATION
Algal Growth Stimulus by Phosphorus in Flathead Lake, Montana, Sediments,
W83-01065 5C

Sedimentation in an Artificial Lake - Lake Matahina, Bay of Plenty,
W83-01084 2J

Dynamics of Mud (Slick) and Suspended Matter in Estuaries. Applicability of By-Products of Surveys of German Coastal Agencies in View of Requirements for Future Needs,
W83-01161 2J

The Dynamics of a River Bend: A Study in Flow and Sedimentary Processes,
W83-01249 2E

SEDIMENTATION RATES
The Deposition of Windscale Radiocaesium in the Wyre Estuary and the Measurement of Sedimentation Rates,
W83-01138 5B

An Improved Method of Determining Sedimentation Rates by the Use of Artificial Radionuclides,
W83-01153 2J

210Pb Geochronology and Trace Metal Concentrations of Sediments from Upper Klamath Lake and Lake Euwana, Oregon,
W83-01252 2J

SEDIMENTS
The Distribution of Lead, Zinc and Cadmium in Sediments of an Ore-Enriched Lotic Ecosystem, the River Ecclesbourne, Derbyshire,
W83-01073 5B

Deposition and Chemistry of Pollutant Metals in Lakes Around the Smelters at Sudbury, Ontario,
W83-01078 5B

Uranium, Thorium and Lead Nuclides in a Delaware Salt Marsh Sediment,
W83-01123 5B

The Deposition of Windscale Radiocaesium in the Wyre Estuary and the Measurement of Sedimentation Rates,
W83-01138 5B

Field and Laboratory Studies of the Toxicity of Phytoplankton of Polychlorinated Biphenyls (PCBs) Desorbed from Fine Clays and Natural Suspended Particulates,
W83-01244 5C

Sediment Fans and Sediment Flows Generated by Snowmelt: Observations at Austerdalsisen, Norway,
W83-01254 2J

Reversible and Resistant Components of PCB Adsorption-Desorption: Adsorbent Concentration Effects,
W83-01264 5B

Density-Driven Interstitial Water Motion in Sediments,
W83-01372 2H

Heavy Metal Concentrations in Shrimp, Crab, and Sediment Obtained from Ad-Dammam Sewage Outfall Area,
W83-01391 5B

SEEPAGE
Seepage Ponds to Recycle Municipal Wastewater,
W83-01238 5D

Steady Non-Darcy Seepage Through Confined Aquifer of Variable Thickness,
W83-01378 2F

SEMIARID LANDS
Modernizing Irrigation Systems in Alberta,
W83-01232 4A

SEPTIC TANKS
High-Density Use of Septic Systems, Avon Lake, Iowa,
W83-01082 5D

Effects of Residential Wastewater-Treatment Systems on Ground-Water Quality in West-Central Jefferson County, Colorado,
W83-01182 5C

The Septic Tank as a Wastewater Treatment and Disposal Facility,
W83-01241 5D

Effectiveness of Septic Systems in Safeguarding the Groundwater in Maine,
W83-01278 5G

SEWAGE DISPOSAL
The Recovery of L. Vesijarvi Following Sewage Diversion,
W83-01158 5G

SEWAGE SYSTEMS
Opinion,
W83-01346 5G

SEWER SYSTEMS
Creation and Operation of the Metropolitan St. Louis Sewer District,
W83-01209 5D

Combined Sewers: Maintaining Yesterday's Infrastructure with Today's Technology,
W83-01211 5D

Low Cost Technology for Disposal of Human Excreta with Community Latrines,
W83-01319 5D

Sliplining Ends Gadsden Infiltration.
W83-01344 5G

SHALLOW WATER
Tensor Structure of the Coefficient of Hydraulic Friction,
W83-01096 8B

SHAPE
Raindrop Axial Ratios,
W83-01092 2B

SHEAR STRESS
Tensor Structure of the Coefficient of Hydraulic Friction,
W83-01096 8B

SHORES
Dynamics of the Foreshore of a Large Aggradational Feature in the Northwestern Black Sea,
W83-01095 2J

SILTING
The Dying Estuary,
W83-01291 6G

SLIPLINING
Sliplining Ends Gadsden Infiltration.
W83-01344 5G

SLOPE STABILITY
Laboratory Investigation of the Structure of the Flow and Bottom Features in River Mouth Regions,
W83-01099 2E

SLUDGE DIGESTION
Optimized Energy Exploitation through Aerobic-Anaerobic Two-Phase Stabilization (Optimierte Energieausnutzung Durch die Aerob-Anaerob Zweiphasen-Stabilisation),
W83-01304 5D

Process Design of Anaerobic Sludge Digestion,
W83-01353 5D

SLUDGE DISPOSAL
Sludge Marketing: The Quiet Revolution,
W83-01208 5E

Microbial Contamination of Continental Shelf Sediments by Wastewater Sludge,
W83-01214 5B

Where We Are But Where Are We Going,
W83-01215 5E

Pathogenic Amoebae in Ocean Sediments Near Wastewater Sludge Disposal Sites,
W83-01216 5C

Effluent--A Question of Sludge,
W83-01334 5E

SLUDGE FILTERS
Effluent--A Question of Sludge,
W83-01334 5E

SLUDGE SOLIDS
Primary Sludge Mass Flow Measurement,
W83-01336 5E

SMALL WATERSHEDS
Stochastic Predictions of Sediment Yields from Small Coastal Watersheds in Oregon, U.S.A.,
W83-01053 2J

SMELTING
Deposition and Chemistry of Pollutant Metals in Lakes Around the Smelters at Sudbury, Ontario,
W83-01078 5B

SNOWMELT
Sediment Fans and Sediment Flows Generated by Snowmelt: Observations at Austerdalsisen, Norway,
W83-01254 2J

SNOWPACK
Snow Stratography and Water Equivalence Measured with an Active Microwave System,
W83-01060 2C

SOIL ABSORPTION CAPACITY
The Septic Tank as a Wastewater Treatment and Disposal Facility,
W83-01241 5D

SOIL ADSORPTION
Fate of Polychlorinated Biphenyls (PCBs) in Soil Plant Systems,
W83-01235 5B

SOIL ADSORPTION SYSTEMS
Effectiveness of Septic Systems in Safeguarding the Groundwater in Maine,
W83-01278 5G

SOIL AMENDMENTS
Sludge Marketing: The Quiet Revolution,
W83-01208 5E

SOIL CONSERVATION
The Te Awa Research: 35 Years of Soil Conservation,
W83-01169 4D

Soil Conservation Protects the Trout,
W83-01294 4D

SOIL MOISTURE
A Field Test of a Conceptual Computer Simulation Model for Predicting Water and Salt Distribution,
W83-01309 2G

Application of Deterministic Conceptual Model for Water Balance Studies,
W83-01387 2A

SOIL-PLANT SYSTEMS
Fate of Polychlorinated Biphenyls (PCBs) in Soil Plant Systems,
W83-01235 5B

SOIL WATER
Chemical Interactions Between Forest Soils and Acidic Precipitation During a Dormant Season on Wildcat Run Watershed in Southwestern Pennsylvania,
W83-01236 2K

Effects of Water on the Fate of Herbicides in Irrigated Soils,
W83-01355 5B

A Conceptual Model of Water Transport Through Unsaturated Soil Zone,
W83-01376 2G

SOIL-WATER-PLANT RELATIONSHIPS
Responses to Water Stress in Wheat and Related Wild Species,
W83-01145 3F

SOIL WATER POTENTIAL
The Influence of Low-Angled Topography on Hillslope Soil-Water Convergence and Stream Discharge,
W83-01213 2G

SOLID RETENTION TIME
SRT Technique in Wastewater Process Design,
W83-01297 5D

SOLUBILITY
Pesticide Partitioning in Artificial Surface Films,
W83-01256 5B

Fractionation of Hydrophobic Origin Materials in Surface Microlayers,
W83-01266 5B

SOLUTE TRANSPORT
Geochemical Denudation Rates and Solute Transport Mechanisms in a Maritime Temperate Glacier Basin,
W83-01109 2C

SOLVENT EXTRACTION
Progress Toward a Solution to the Nitrate Problem,
W83-01072 5F

Equilibrium Distribution Coefficients for Extraction of Chlorinated Hydrocarbons and Aromatics from Water into Undecane,
W83-01076 5D

SORPTION
Sorption of Phenol by Chemically Treated Flyash,
W83-01296 5D

SOURIS-RED-RAINY RIVER BASIN
Water Resources Data, Minnesota, Water Year 1981. Volume 1. Great Lakes and Souris-Red-Rainy River Basins.
W83-01398 7C

SOUTH CAROLINA
Responses of Experimental Estuarine Communities to Continuous Chlorination,
W83-01131 5C

The Structure of Two South Carolina Estuarine Tide Pool Fish Assemblages,
W83-01137 2L

Ground Water Geochemistry of 228Ra, 226Ra, and 222Rn,
W83-01157 5A

SOUTH DAKOTA
Magnitude and Frequency of Floods from Selected Drainage Basins in South Dakota,
W83-01193 4A

Seepage Ponds to Recycle Municipal Wastewater,
W83-01238 5D

SOYBEANS
Irrigation for Crops in a Sub-Humid Environment, I. The Effect of Irrigation on the Growth and Yield of Soybeans,
W83-01288 3F

Canopy Air Temperatures and Evapotranspiration from Irrigated and Stressed Soybeans,
W83-01313 2D

Irrigation for Crops in a Sub-Humid Environment, II. The Water Requirements of Soybeans,
W83-01314 2I

SPAIN
Phytoplankton Composition and Distribution as an Expression of Properties of Reservoirs,
W83-01224 2H

SPATIAL DISTRIBUTION
Chrysophyceae from Some Greek Lakes,
W83-01064 5C

Dynamics of the Foreshore of a Large Aggradational Feature in the Northwestern Black Sea,
W83-01095 2J

Spatial Variations in Abundance of Phytoplankton, Zooplankton, and Larval Fishes in Center Hill Reservoir,
W83-01230 2H

SPECIATION
The Speciation of Ions in Tiber River Estuary Waters,
W83-01118 5B

SPECIES COMPOSITION
Shifts in Caddisfly Species Composition in Sacramento River Invertebrate Communities in the Presence of Heavy Metal Contamination,
W83-01382 5C

SPECIFIC HUMIDITY
Surface Layers of Air and Water and their Role in Heat and Moisture Exchange Between a Water Body and the Atmosphere,
W83-01113 2D

SPECTROMETRY
Continuous Monitoring of Total and Inorganic Mercury in Wastewater and Other Waters,
W83-01380 5A

SPECTROPHOTOMETRY
Automated Prevalve Sample Filtration in Flow Injection Analysis: Determination of Sulphate in Water Removing Suspended Solids and Colour Before Sampling,
W83-01303 5A

Spectrophotometric Determination of Aluminum in River Water with Bromopyrogallol Red and n-Tetradecyltrimethylammonium Bromide by Flow Injection Analysis,
W83-01389 5A

SPILLWAYS
Predicting Cavitation in Tunnel Spillways,
W83-01285 8B

SPRINKLER IRRIGATION
A Greenhouse Line-Source Sprinkler System for Evaluating Plant Response to a Water Application Gradient,
W83-01162 3F

Computer Evaluation of Sprinkler Irrigation Uniformity,
W83-01290 3F

SRICSI SCORES
The Selection of Fishery Parameters for Inclusion in the Stream Reach Inventory and Channel Stability Index,
W83-01364 6G

STABILITY ANALYSIS
Stability Analysis of Water Movement in Unsaturated Porous Materials. I. Theoretical Considerations,
W83-01200 2G

STABILIZATION PONDS
Seepage Ponds to Recycle Municipal Wastewater,
W83-01238 5D

STATISTICAL ANALYSIS
Statistical Analysis of Estuarine Profiles: Application to Manganese and Ammonium in the Tamar Estuary,
W83-01154 2L

STATISTICAL METHODS
Application of Statistical Methods to Forecasting of Natural Groundwater Tables,
W83-01108 4B

Statistical Characteristics of Some Indian Hydrologic Time Series,
W83-01385 2E

STEROLS
High Abundance of Algal 24-Ethylcholesterol in Antarctic Lake Sediment,
W83-01373 2H

STOCHASTIC PROCESS
Stochastic Predictions of Sediment Yields from Small Coastal Watersheds in Oregon, U.S.A.,
W83-01053 2J

Stochastic Approach to Evaluating the Effectiveness of Reclamation Measures,
W83-01093 6A

STORM RUNOFF
A Microprocessor Controlled System for Storm Water Sampling (Ein Mikroprozessor-Gesteurtes System Zur Probennahme Aus Regeneasserkanalen),
W83-01342 7A

STRATIFICATION
Mathematical Model for Partially Mixed Estuaries Using the Turbulence Energy Equation,
W83-01133 2L

STRATIGRAPHY
Snow Stratography and Water Equivalence Measured with an Active Microwave System,
W83-01060 2C

STREAM BANKS
The Selection of Fishery Parameters for Inclusion in the Stream Reach Inventory and Channel Stability Index,
W83-01364 6G

STREAM DISCHARGE
The Influence of Low-Angled Topography on Hillslope Soil-Water Convergence and Stream Discharge,
W83-01213 2G

STREAMFLOW
Streamflow and Water-Quality Conditions, Wilsons Creek and James River, Springfield Area, Missouri,
W83-01192 4C

Watersheds in Muskeg Terrain. 1. The Chemistry of Water Systems,
W83-01206 2K

STREAMS
The Influence of Atmospheric Nitrogen Influx Upon the Stream Nitrogen Profile of a Relatively Undisturbed Forested Watershed,
W83-01059 5B

An Analysis of Factors Influencing De-Icing Salt Levels in Streams,
W83-01088 5B

STREPTOCOCCUS
Refinement of the Identification and Speciation Schemes of Fecal Streptococci,
W83-01365 5A

SUBLETHAL STRESS
In Situ Survival of Enteric Bacteria in Estuarine Environments of Different Nutrient Characteristics,
W83-01281 2L

SUBTROPIC ZONE
Chrysophyceae from Some Greek Lakes,
W83-01064 5C

SULFATE
Automated Prevalve Sample Filtration in Flow Injection Analysis: Determination of Sulphate in Water Removing Suspended Solids and Colour Before Sampling,
W83-01303 5A

SULFATES
Isotope Hydrogeology and Geothermometry of the Mount Meager Geothermal Area,
W83-01102 2F

SULFIDES
Usefulness of Sediment Oxygen as a Tool for Impoundment Management,
W83-01371 5B

SULFUR COMPOUNDS
Acid Deposition,
W83-01217 5C

SURFACE FILMS
Microbiota in Surface Films: An Historical Perspective,
W83-01245 5B

Overview of Atmospheric Inputs and Losses from Films,
W83-01246 5B

Pesticide Partitioning in Artificial Surface Films,
W83-01256 5B

SURFACE RUNOFF
Decolorization of Infiltration Water Under Natural Conditions,
W83-01097 2F

SURFACE WATER
Water Resources Data, Utah, Water Year 1981.
W83-01178 7C

Water Resources Data, Virginia, Water Year 1981.
W83-01179 7C

Water Resources Data, Minnesota, Water Year 1981. Volume 2. Upper Mississippi and Missouri River Basins.
W83-01397 7C

Water Resources Data, Minnesota, Water Year 1981. Volume 1. Great Lakes and Souris-Red-Rainy River Basins.
W83-01398 7C

Water Resources Data, Illinois, Water Year 1981. Volume 2. Illinois River Basin.
W83-01399 7C

Water Resources Data, Illinois, Water Year 1981. Volume 1. Illinois Except Illinois River Basin.
W83-01400 7C

SURFACTANTS
2,4,6-Trinitrotoluene-Surfactant Complexes: Decomposition, Mutagenicity, and Soil Leaching Studies,
W83-01067 5B

Anionic Surfactant Concentration in the River and Sea Waters of Hyogo Pref. and its Relationship to Phosphorus Concentration, (In Japanese),
W83-01152 5B

SURVEYS
The Phytoplankton of Some Freshwater Bodies from Zulia State (Venezuela),
W83-01063 2H

SUSPENDED SEDIMENTS
On the Use of the Nephelometer in Estuarine Waters,
W83-01135 5A

Dynamics of Mud (Slick) and Suspended Matter in Estuaries. Applicability of By-Products of Surveys of German Coastal Agencies in View of Requirements for Future Needs,
W83-01161 2J

Field and Laboratory Studies of the Toxicity of Phytoplankton of Polychlorinated Biphenyls (PCBs) Desorbed from Fine Clays and Natural Suspended Particulates,
W83-01244 5C

Effect of Suspended Sediment on Feeding by Larval Herring (Clupea Harengus Harengus L.),
W83-01383 5C

SWEDEN
Mechanism Governing the Estuarine Circulation in Deep, Strongly Stratified Fjords,
W83-01132 2L

Changes in the Phytoplankton of Lake Trummen Induced by Restoration,
W83-01159 5G

SWITZERLAND
Measuring Station to Determine Pore Water Pressure - Zervreila Arch Dam (Messanlage Fur Porenwasserduck - Bogenstaumauer Zervreila),
W83-01100 8G

TAXONOMY
The Phytoplankton of Some Freshwater Bodies from Zulia State (Venezuela),
W83-01063 2H

Some Diatoms from Brackish Water Habitats in Southern Iraq,
W83-01306 2L

Freshwater Red Algae A New Addition to the Iraqi Flora,
W83-01322 2H

TEMPERATURE EFFECTS
Effect of Elevated Water Temperature on Macroinvertebrate Communities in Outdoor Experimental Channels,
W83-01195 5C

TENNESSEE
The Influence of Atmospheric Nitrogen Influx Upon the Stream Nitrogen Profile of a Relatively Undisturbed Forested Watershed,
W83-01059 5B

Precipitation Data for Burial Grounds 5 and 6, Oak Ridge National Laboratory, Tennessee, 1976-1980,
W83-01183 7C

Spatial Variations in Abundance of Phytoplankton, Zooplankton, and Larval Fishes in Center Hill Reservoir,
W83-01230 2H

TEXAS
Sedimental Journey,
W83-01140 5E

Path Analysis of a Reservoir Ecosystem Model,
W83-01228 6G

More Water for Texas Coastal Plains.
W83-01333 8A

THE NETHERLANDS
Influence of pH on the Fluorescence of Dissolved Organic Matter,
W83-01128 2L

Mobilization of Copper from Modified Peat by Dissolved Organic Matter in Natural Waters and Biologically Purified Wastewaters,
W83-01341 5B

THERMAL POLLUTION
Thermophillic and Thermotolerant Fungi Isolated from the Thermal Effluent of Nuclear Power Generating Reactors: Dispersal of Human Opportunistic and Veterinary Pathogenic Fungi,
W83-01375 5C

TIDAL CURRENTS
The Tidal Instrusion Front: An Estuarine Convergence Zone,
W83-01177 2L

TIDAL EFFECTS
Low-Frequency Variations in Sea Level and Currents in South San Francisco Bay,
W83-01057 2L

Tidal Export of Particulate Organic Matter from a Northern Australian Mangrove System,
W83-01124 2L

TIDAL FLOODS
The Tidal Instrusion Front: An Estuarine Convergence Zone,
W83-01177 2L

TIDAL HYDRAULICS
A Note on Tidal Asymmetry in the Severn Estuary,
W83-01134 2L

TIDAL RIVERS
The Structure of Two South Carolina Estuarine Tide Pool Fish Assemblages,
W83-01137 2L

TIDEWATER
Stable Density Fronts and Dinoflagellate Patches in a Tidal Estuary,
W83-01121 2L

TILLAGE
Conservation Tillage Effects on Water Conservation,
W83-01240 3F

TITRATION
Influence of Kinetics on the Direct Titration Curves of Natural Water Systems - Theoretical Considerations,
W83-01388 5A

TOPOGRAPHY
The Influence of Low-Angled Topography on Hillslope Soil-Water Convergence and Stream Discharge,
W83-01213 2G

Passage of Floods Over River Floodplains,
W83-01233 2E

TOXICITY
Field and Laboratory Studies of the Toxicity of Phytoplankton of Polychlorinated Biphenyls (PCBs) Desorbed from Fine Clays and Natural Suspended Particulates,
W83-01244 5C

TRACE ELEMENTS
Variation of Trace Element Concentration in Rainwater with Rainfall Rate and Rainfall Amount,
W83-01379 5A

TRACE METALS
Trace Metal Accumulation in Surface Microlayers,
W83-01248 5B

Atmospheric Role in Trace Metal Exchange at the Air-Water Interface,
W83-01255 5B

Influence of Kinetics on the Direct Titration Curves of Natural Water Systems - Theoretical Considerations,
W83-01388 5A

TRACE ORGANICS
Comparison of Continuous Extractors for the Extraction and Concentration of Trace Organics from Water,
W83-01381 5A

TRACERS
Time of Travel of Solutes in the Vermilion River, Louisiana,
W83-01189 5B

TRASHRACKS
Some Design Factors for the Bath County Trashracks,
W83-01312 8C

TRIHALOMETHANE FORMATION
Removal of Humic Substances and Turbidity in Water Supply Sources by Polymer Coagulation and Direct Filtration,
W83-01239 5F

TRIHALOMETHANES
The Influence of Algal Growth and Other Ecological Factors in Reservoirs on the Production and Control of Trihalomethane Precursors,
W83-01279 5F

Treatment Technology to Meet the Drinking Water Standards for Trihalomethanes for Jackson, Mississippi,
W83-01360 5F

TRITICUM
Responses to Water Stress in Wheat and Related Wild Species,
W83-01145 3F

TROPHIC LEVEL
Simple Trophic State Classification of the Canadian Nearshore Waters of the Great Lakes,
W83-01199 5C

Bacterial Enrichments in Surface Films of Freshwater Lakes,
W83-01261 2H

TROUT
The Selection of Fishery Parameters for Inclusion in the Stream Reach Inventory and Channel Stability Index,
W83-01364 6G

TURBIDITY
Mathematical Model for Partially Mixed Estuaries Using the Turbulence Energy Equation,
W83-01133 2L

Primary Production in a Turbid Estuary,
W83-01155 2L

Removal of Humic Substances and Turbidity in Water Supply Sources by Polymer Coagulation and Direct Filtration,
W83-01239 5F

TURBINES
Desalination-Power Cycles with the Biphase Rotary Separator Turbine, Phase 3,
W83-01370 3A

TURBULENCE
Mathematical Model for Partially Mixed Estuaries Using the Turbulence Energy Equation,
W83-01133 2L

TURBULENT FLOW
The Effect of Aspect Ratio on Longitudinal Diffusivity in Rectangular Channels,
W83-01115 8B

ULTRAFILTRATION
Evaluation of Desalination Technology for Wastewater Reuse.
W83-01270 5D

Application of Non-Fouling Ultrafiltration Membranes in Water Conversion Technology,
W83-01277 3A

UNDECANE
Equilibrium Distribution Coefficients for Extraction of Chlorinated Hydrocarbons and Aromatics from Water into Undecane,
W83-01076 5D

UNIFORM FLOW
Direct Solution for Uniform Flows in Elliptical Channels,
W83-01284 8B

UPPER MISSISSIPPI RIVER BASIN
Water Resources Data, Minnesota, Water Year 1981. Volume 2. Upper Mississippi and Missouri River Basins.
W83-01397 7C

URBAN RUNOFF
Streamflow and Water-Quality Conditions, Wilsons Creek and James River, Springfield Area, Missouri,
W83-01192 4C

USSR
Passage of Floods Over River Floodplains,
W83-01233 2E

Kurpsai Hydroelectric Station on the Naryn River,
W83-01234 8A

UTAH
Fluid-Mineral Equilibria in a Hydrothermal System, Roosevelt Hot Springs, Utah,
W83-01142 2K

Water Resources Data, Utah, Water Year 1981.
W83-01178 7C

UTILITIES
Financial Planning During Times of Economic Uncertainty,
W83-01054 6C

Funding Improvements with Debt Capital and Revenues,
W83-01055 6C

Creative Financing Techniques for Water Utilities,
W83-01056 6C

The Role of Investment Banking Firms in Managing Water Project Financing,
W83-01081 6C

VALVES
Advances in Water and Wastewater Valves.
W83-01340 8C

VAPOR PRESSURE
Saturated Vapor Pressure of Water and Activity Coefficients of Calcium Chloride in the CaCl2-H20 System at 423-623K,
W83-01250 1A

VARIATION ANALYSIS
Rainfall Variation Analysis and Optimization of Gaging Systems,
W83-01202 2B

VEGETATION
Solving a Drainage Ditch Vegetation Problem.
W83-01332 4A

VELOCITY
Velocity Variations in Salt Marsh Creeks, Norfolk, England,
W83-01176 2L

VENEZUELA
The Phytoplankton of Some Freshwater Bodies from Zulia State (Venezuela),
W83-01063 2H

VIBRATIONS
Axial Flow-Induced Vibrations in Large High-Head Machines,
W83-01311 8C

VIRGINIA
Water Resources Data, Virginia, Water Year 1981.
W83-01179 7C

The Influence of Algal Growth and Other Ecological Factors in Reservoirs on the Production and Control of Trihalomethane Precursors,
W83-01279 5F

VOLATILITY
Effects of Surface Films on Air-Water Exchange Rates,
W83-01262 5C

VOLCANOES
A Pilot Study of Potential Phenolic Contamination of Fishes in the Columbia River and Tributaries in the Vicinity of Mount St. Helens,
W83-01354 5C

WALES
Radar and Raingauge Observations of Orographic Rain over South Wales,
W83-01061 2B

The Tidal Instrusion Front: An Estuarine Convergence Zone,
W83-01177 2L

WASHINGTON
A Pilot Study of Potential Phenolic Contamination of Fishes in the Columbia River and Tributaries in the Vicinity of Mount St. Helens,
W83-01354 5C

WASTE DISPOSAL
Leaching of Cadmium from Pigmented Plastics in a Landfill Site,
W83-01068 5B

Protecting Public Groundwater Supplies,
W83-01071 5G

Stream Water Quality in a Small Commercial Campground in Colorado,
W83-01090 5B

Water-Quality and Hydrogeologic Data for Three Phosphate Industry Waste-Disposal Sites in Central Florida, 1979-80,
W83-01190 7C

WASTE MANAGEMENT
Sedimental Journey,
W83-01140 5E

Wastewater Tight,
W83-01141 5G

WASTEWATER COLLECTION
Costs of Preventive Maintenance Programs in Wastewater Collection Systems,
W83-01339 5D

WASTEWATER DISPOSAL
The Definition and Use of Mixing Zones,
W83-01070 5G

Zonation of Inshore Benthos off a Sewage Outfall in Hawke Bay, New Zealand,
W83-01085 5C

Factors Affecting the Distribution of the Bivalve, Macoma Balthica (L.) on a Mudflat Receiving Sewage Effluent, Fraser River Estuary, British Columbia,
W83-01127 5C

Environmental Improvement on Narragansett Bay as a Result of Section 312 Implementation of the Federal Water Pollution Control Act,
W83-01130 5G

WASTEWATER FACILITIES
Experience Report for Decentralized Wastewater Treatment (Erfahrungsbericht Mit Der Dezentralen Abwasserreinigung),
W83-01326 5D

First Operational Experience at the Wastewater Treatment Facility of the Breisgauer Bucht Wastewater Association (Erste Betriebserfahrungen auf der Klaranlage des Abwasserzweckverbandes Breisgauer Bucht),
W83-01327 5D

WASTEWATER MANAGEMENT
Where We Are But Where Are We Going,
W83-01215 5E

WASTEWATER POLLUTION
Relationships Between Candida Albicans and Traditional Bacterial Indicators of Pollution in Wastewater and Receiving Waters,
W83-01362 5A

WASTEWATER RENOVATION
Legal Issues in Implementing Water Reuse in California,
W83-01074 6E

WASTEWATER TREATMENT
New Aeration System Cuts Waste Treatment Costs at Badger Paper,
W83-01062 5D

Control by Alkaline Neutralization of Trace Elements in Acidic Coal Cleaning Waste Leachates,
W83-01075 5G

Equilibrium Distribution Coefficients for Extraction of Chlorinated Hydrocarbons and Aromatics from Water into Undecane,
W83-01076 5D

Dynamics of Biofilm Processes,
W83-01080 5D

High-Density Use of Septic Systems, Avon Lake, Iowa,
W83-01082 5D

Dynamic Simulator for Anaerobic Digestion Processes,
W83-01105 5D

Fluidized-Bed Fermenters: A Steady-State Analysis,
W83-01106 5D

Mass Transfer in a Rotating Biological Contractor,
W83-01198 5D

Alpha and Beta Factors for Domestic Wastewater,
W83-01207 5D

Creation and Operation of the Metropolitan St. Louis Sewer District,
W83-01209 5D

The Septic Tank as a Wastewater Treatment and Disposal Facility,
W83-01241 5D

Evaluation of Desalination Technology for Wastewater Reuse.
W83-01270 5D

Weak-Electrolyte Ion Exchange in Advanced-Technology Water-Reuse Systems,
W83-01275 5D

Sorption of Phenol by Chemically Treated Flyash,
W83-01296 5D

SRT Technique in Wastewater Process Design,
W83-01297 5D

Water Hyacinth for Treating Dairy Waste,
W83-01298 5D

Treatment of Dairy Waste by Flocculating Algael Bacterial System,
W83-01299 5D

Optimized Energy Exploitation through Aerobic-Anaerobic Two-Phase Stabilization (Optimierte Energieausnutzung Durch die Aerob-Anaerob Zweiphasen-Stabilisation),
W83-01304 5D

Precipitation Treatment of Municipal Wastewater with Added Activated Carbon (Fallungsreinigung Von Kommunalem Abwasser Mit Zusatz Von Aktivkohle),
W83-01307 5D

Nitrogen Removal With Rotating Disc System (Stickstoffelimination Mit Dem Tauchtropfkorper),
W83-01323 5D

Nitrogen Removal by Means of Preliminary Denitrification (Stickstoffelimination Durch Vorgeschaltete Denitrifikation),
W83-01324 5D

Causes, Prevention and Control of Bulking Sludge in Activated Sludge Plants (Ursachen, Verhinderung Und Bekampfung Der Blahschlammbildung in Belebungsanlagen),
W83-01325 5D

First Operational Experience at the Wastewater Treatment Facility of the Breisgauer Bucht Wastewater Association (Erste Betriebserfahrungen auf der Klaranlage des Abwasserzweckverbandes Breisgauer Bucht),
W83-01327 5D

Advances in Water and Wastewater Valves.
W83-01340 8C

Frito-Lay Turns Waste Into Profit.
W83-01351 5D

Process Design of Anaerobic Sludge Digestion,
W83-01353 5D

Evaluation of the Use of Iodine for Disinfection of Effluent from On-Site 'Package' Wastewater Treatment Systems,
W83-01361 5D

An Investigation into the Removal of Algae by Fine Sand/Silt Filtration,
W83-01367 5D

Design Considerations for Use of On-Site Sand Filters for Wastewater Treatment,
W83-01368 5D

WASTEWATER TREATMENT PLANTS
Presence of Enteric Microorganisms in the Air Environment at Wastewater Treatment Plants in Puerto Rico,
W83-01272 5D

WASTEWATERS
Water Quality Considerations in the Slurry Pipelining of Coal,
W83-01273 5B

WATER ALLOCATION
An Economic Evaluation of Interbasin Water Transfers: A Case Study of Southwestern Connecticut,
W83-01271 6C

WATER ANALYSIS
Extractable Organic Matter in Municipal Wastewaters. 2. Hydrocarbons: Molecular Characterization,
W83-01077 5A

Evaluation of a Persulfate Digestion Method for Particulate Nitrogen and Phosphorus,
W83-01196 5A

Effect of Container Type on pH and Alkalinity Stability,
W83-01197 5A

Determination of Total Kjeldahl Nitrogen and Total Phosphorus in Surface Waters and Wastewaters,
W83-01210 5A

What's in the Water,
W83-01292 5A

Automated Prevalve Sample Filtration in Flow Injection Analysis: Determination of Sulphate in Water Removing Suspended Solids and Colour Before Sampling,
W83-01303 5A

Quantitative Determination of Volatile Halogenated Hydrocarbons in Water Samples by Capillary Gas Chromatography and Electron Capture Detection,
W83-01338 5A

Continuous Monitoring of Total and Inorganic Mercury in Wastewater and Other Waters,
W83-01380 5A

Comparison of Continuous Extractors for the Extraction and Concentration of Trace Organics from Water,
W83-01381 5A

Influence of Kinetics on the Direct Titration Curves of Natural Water Systems - Theoretical Considerations,
W83-01388 5A

Spectrophotometric Determination of Aluminum in River Water with Bromopyrogallol Red and n-Tetradecyltrimethylammonium Bromide by Flow Injection Analysis,
W83-01389 5A

WATER CIRCULATION
Mechanism Governing the Estuarine Circulation in Deep, Strongly Stratified Fjords,
W83-01132 2L

Patterns of Circulation and Nutrient Supply in a Medium Residence-Time Reservoir Kootenay Lake, British Columbia,
W83-01223 2H

WATER CONSERVATION
Conservation Tillage Effects on Water Conservation,
W83-01240 3F

Water Resource Management and Conservation for the Future,
W83-01274 3D

An Investigation of Psychological Components of Water Conservation Behavior,
W83-01363 3D

WATER DEMAND
Water Demand on the Rakaia,
W83-01315 6D

WATER DISTRIBUTION
Water Regulations,
W83-01144 6E

WATER EQUIVALENCE
Snow Stratography and Water Equivalence Measured with an Active Microwave System,
W83-01060 2C

WATER LAW
Federal Common Law and its Application to Disputes Involving Accretive and Avulsive Changes in the Bounds of Navigable Waters,
W83-01160 6E

WATER LEVEL FLUCTUATIONS
Inflow and Levels of the Caspian Sea and Their Variations Under the Effect of Climatic Factors and Economic Activity,
W83-01094 4A

WATER LOSS
Correlation Procedures to Reduce Water Losses (Korrelationsverfahren Zur Wasserverlusminderung),
W83-01305 5F

A Weighing Lysimeter for Use in Isolated Field Areas,
W83-01308 2G

WATER MANAGEMENT
Changes in the Phytoplankton of Lake Trummen Induced by Restoration,
W83-01159 5G

Mahurangi, Problems of Management,
W83-01168 6G

Hydrologic Maps of the Ogallala Aquifer, West-Central Kansas, 1979-81,
W83-01188 7C

Water Resource Management and Conservation for the Future,
W83-01274 3D

Drainage Is the Byword in Louisiana Parish.
W83-01348 4A

WATER POLLUTION

Water-Quality and Hydrogeologic Data for Three Phosphate Industry Waste-Disposal Sites in Central Florida, 1979-80,
W83-01190 7C

Water Quality Considerations in the Slurry Pipelining of Coal,
W83-01273 5B

WATER POLLUTION CONTROL

Mass Balance Modeling of DDT Dynamics in Lakes Michigan and Superior,
W83-01069 5B

Changes in the Phytoplankton of Lake Trummen Induced by Restoration,
W83-01159 5G

WATER POLLUTION EFFECTS

Avon-Heathcote, Estuary Under Stress,
W83-01149 5B

The Estuarine Zone, an Overview,
W83-01163 2L

Effects of Residential Wastewater-Treatment Systems on Ground-Water Quality in West-Central Jefferson County, Colorado,
W83-01182 5C

Evaluation of Microcosms for Determining the Fate and Effect of Benz(a)anthracene in Aquatic Systems,
W83-01282 5B

A Pilot Study of Potential Phenolic Contamination of Fishes in the Columbia River and Tributaries in the Vicinity of Mount St. Helens,
W83-01354 5C

Environmental Factors Promoting and Regulating N2 Fixing Blue-Green Algal Blooms in the Chowan River, NC,
W83-01357 5C

The Effects of Recreation on Freshwater Plants and Animals: A Review,
W83-01390 5C

WATER POLLUTION INDICATORS

Relationships Between Candida Albicans and Traditional Bacterial Indicators of Pollution in Wastewater and Receiving Waters,
W83-01362 5A

WATER POLLUTION SOURCES

2,4,6-Trinitrotoluene-Surfactant Complexes: Decomposition, Mutagenicity, and Soil Leaching Studies,
W83-01067 5B

Protecting Public Groundwater Supplies,
W83-01071 5G

The Deposition of Windscale Radiocaesium in the Wyre Estuary and the Measurement of Sedimentation Rates,
W83-01138 5B

Avon-Heathcote, Estuary Under Stress,
W83-01149 5B

Anionic Surfactant Concentration in the River and Sea Waters of Hyogo Pref. and its Relationship to Phosphorus Concentration, (In Japanese),
W83-01152 5B

Saline Ground-Water Discharge to the Smoky Hill River Between Salina and Abilene, Central Kansas,
W83-01191 5G

Watching the River's Flow.
W83-01310 5B

Variation of Trace Element Concentration in Rainwater with Rainfall Rate and Rainfall Amount,
W83-01379 5A

WATER QUALITY

The Effects of Mining Southland Lignite on Water and Soil Resources,
W83-01151 6G

Water Resources Data, Utah, Water Year 1981.
W83-01178 7C

Water Resources Data, Virginia, Water Year 1981.
W83-01179 7C

Effects of Residential Wastewater-Treatment Systems on Ground-Water Quality in West-Central Jefferson County, Colorado,
W83-01182 5C

Water-Table Map of the San Jose Well Field and Vicinity, Albuquerque, New Mexico, Spring 1981,
W83-01184 7C

Ground-Water Quality and Data on Wells and Springs in Pennsylvania, Volume III--Delaware River Basin,
W83-01185 7C

Ground-Water Quality and Data on Wells and Springs in Pennsylvania, Volume II--Susquehanna and Potomac River Basins,
W83-01186 7C

Water-Quality and Hydrogeologic Data for Three Phosphate Industry Waste-Disposal Sites in Central Florida, 1979-80,
W83-01190 7C

Streamflow and Water-Quality Conditions, Wilsons Creek and James River, Springfield Area, Missouri,
W83-01192 4C

Simple Trophic State Classification of the Canadian Nearshore Waters of the Great Lakes,
W83-01199 5C

The Establishment of Water Quality Gradients in Reservoirs,
W83-01222 5B

Phytoplankton Composition and Distribution as an Expression of Properties of Reservoirs,
W83-01224 2H

Water Renewal Effects on Reservoir Zooplankton Communities,
W83-01226 2H

Chemical Interactions Between Forest Soils and Acidic Precipitation During a Dormant Seasón on Wildcat Run Watershed in Southwestern Pennsylvania,
W83-01236 2K

What's in the Water,
W83-01292 5A

River Water Quality for Bathing Purposes,
W83-01320 5C

The U.S.: Rethinking Filtration and Disinfection,
W83-01331 5F

Continuous Monitoring of Total and Inorganic Mercury in Wastewater and Other Waters,
W83-01380 5A

Water Resources Data, Minnesota, Water Year 1981. Volume 2. Upper Mississippi and Missouri River Basins.
W83-01397 7C

Water Resources Data, Minnesota, Water Year 1981. Volume 1. Great Lakes and Souris-Red-Rainy River Basins.
W83-01398 7C

Water Resources Data, Illinois, Water Year 1981. Volume 2. Illinois River Basin.
W83-01399 7C

Water Resources Data, Illinois, Water Year 1981. Volume 1. Illinois Except Illinois River Basin.
W83-01400 7C

WATER QUALITY CONTROL

Recent Investigations on the Eutrophication and Restoration of Lake Constance (Neuere Untersuchungen Uber Die Eutrophierung Und Sanierung Des Bodensees),
W83-01321 5G

Hydrotec - A Geotextile Water Well Screen,
W83-01345 5F

WATER RATES

Financial Planning During Times of Economic Uncertainty,
W83-01054 6C

Setting Equitable Water Rates,
W83-01330 6C

WATER REQUIREMENTS

An Economic Evaluation of Interbasin Water Transfers: A Case Study of Southwestern Connecticut,
W83-01271 6C

Irrigation for Crops in a Sub-Humid Environment, II. The Water Requirements of Soybeans,
W83-01314 2I

WATER RESOURCES DEVELOPMENT

Ohiwa Harbour, Natural Values,
W83-01146 6G

Preventing Erosion, Landslip and Flooding, A Planning Approach,
W83-01147 6F

Avon-Heathcote, Estuary Under Stress,
W83-01149 5B

A River Study.
W83-01150 5G

The Estuarine Zone, an Overview,
W83-01163 2L

The National Development Act and Regional Water Boards,
W83-01167 6E

Mahurangi, Problems of Management,
W83-01168 6G

Wood and Water,
W83-01171 6D

Water to Play With,
W83-01172 6D

Manganui-a-te-Ao: The Tug of War River.
W83-01174 6G

The Onflow of Irrigation Schemes,
W83-01318 3B

Expansion Planning of Water Supply Projects in Tegucigalpa, Honduras (Ausbauplanung Von Wasserversorgungsprojekten in Tegucigalpa, Honduras),
W83-01343 6A

WATER REUSE
Legal Issues in Implementing Water Reuse in California,
W83-01074 6E

Evaluation of Desalination Technology for Wastewater Reuse.
W83-01270 5D

Weak-Electrolyte Ion Exchange in Advanced-Technology Water-Reuse Systems,
W83-01275 5D

WATER RIGHTS
Federal Common Law and its Application to Disputes Involving Accretive and Avulsive Changes in the Bounds of Navigable Waters,
W83-01160 6E

A Water Right for Fisheries,
W83-01293 6E

Supreme Court Issues Groundwater Rights Ruling,
W83-01337 6E

Water Transfer Strategy: Energy Vs. Agricultural Use,
W83-01358 6B

WATER SAMPLING
A Microprocessor Controlled System for Storm Water Sampling (Ein Mikroprozessor-Gesteurtes System Zur Probennahme Aus Regeneasserkanalen),
W83-01342 7A

WATER STRESS
Responses to Water Stress in Wheat and Related Wild Species,
W83-01145 3F

A Greenhouse Line-Source Sprinkler System for Evaluating Plant Response to a Water Application Gradient,
W83-01162 3F

Canopy Air Temperatures and Evapotranspiration from Irrigated and Stressed Soybeans,
W83-01313 2D

WATER SUPPLY
An Economic Evaluation of Interbasin Water Transfers: A Case Study of Southwestern Connecticut,
W83-01271 6C

Infiltration Well Used In Hardwar Water Supply,
W83-01301 6B

Egham Expansion Provides Bulk Water Supply.
W83-01335 5F

Planning for Droughts,
W83-01347 6D

WATER SUPPLY DEVELOPMENT
Legal Issues in Implementing Water Reuse in California,
W83-01074 6E

It's all Downhill from Here. The Erewhon Rural Water Supply Scheme,
W83-01170 8A

More or Less Water,
W83-01317 6G

Expansion Planning of Water Supply Projects in Tegucigalpa, Honduras (Ausbauplanung Von Wasserversorgungsprojekten in Tegucigalpa, Honduras),
W83-01343 6A

Municipal Fractured-Rock Wells,
W83-01350 3B

WATER TABLE
Application of Statistical Methods to Forecasting of Natural Groundwater Tables,
W83-01108 4B

Map of Water Table in Solomon River Valley, Waconda Lake to Solomon, North-Central Kansas, May 1980,
W83-01180 7C

Map of Water Table in Graham County, Northwestern Kansas, March 1979,
W83-01181 7C

Water-Table Map of the San Jose Well Field and Vicinity, Albuquerque, New Mexico, Spring 1981,
W83-01184 7C

WATER TABLE FLUCTUATIONS
Groundwater Buildup and Depletion in Islands During Monsoon and Summer,
W83-01052 2F

WATER TEMPERATURE
Surface Layers of Air and Water and their Role in Heat and Moisture Exchange Between a Water Body and the Atmosphere,
W83-01113 2D

WATER TRANSFER
Water Transfer Strategy: Energy Vs. Agricultural Use,
W83-01358 6B

WATER TRANSPORT
A Conceptual Model of Water Transport Through Unsaturated Soil Zone,
W83-01376 2G

WATER TREATMENT
Progress Toward a Solution to the Nitrate Problem,
W83-01072 5F

Dynamics of Biofilm Processes,
W83-01080 5D

Removal of Humic Substances and Turbidity in Water Supply Sources by Polymer Coagulation and Direct Filtration,
W83-01239 5F

Operational Experiences with a Pulsator Clarifier Treating a Coloured Upland Water,
W83-01302 5F

The U.S.: Rethinking Filtration and Disinfection,
W83-01331 5F

Advances in Water and Wastewater Valves.
W83-01340 8C

Treatment Technology to Meet the Drinking Water Standards for Trihalomethanes for Jackson, Mississippi,
W83-01360 5F

An Investigation into the Removal of Algae by Fine Sand/Silt Filtration,
W83-01367 5D

WATER USE
Water Regulations,
W83-01144 6E

Water Resource Management and Conservation for the Future,
W83-01274 3D

Setting Equitable Water Rates,
W83-01330 6C

WEATHER
Radar and Raingauge Observations of Orographic Rain over South Wales,
W83-01061 2B

WELL WATER
What's in the Water,
W83-01292 5A

Infiltration Well Used In Hardwar Water Supply,
W83-01301 6B

WELLS
Hydrotec - A Geotextile Water Well Screen,
W83-01345 5F

Pitless Equipment,
W83-01349 5F

Municipal Fractured-Rock Wells,
W83-01350 3B

WHEAT
Responses to Water Stress in Wheat and Related Wild Species,
W83-01145 3F

WISCONSIN
New Aeration System Cuts Waste Treatment Costs at Badger Paper,
W83-01062 5D

Wastewater Tight,
W83-01141 5G

WYOMING
Organic Contaminants in Groundwater Near an Underground Coal Gasification Site in Northeastern Wyoming,
W83-01066 5B

YEAST
Relationships Between Candida Albicans and Traditional Bacterial Indicators of Pollution in Wastewater and Receiving Waters,
W83-01362 5A

ZAPATA SWAMP
Cuba's Zapata Project,
W83-01328 6G

ZINC
The Distribution of Lead, Zinc and Cadmium in Sediments of an Ore-Enriched Lotic Ecosystem, the River Ecclesbourne, Derbyshire,
W83-01073 5B

ZOOPLANKTON
Relationships Between Organically Bound Cu Mn in Settling Particulate Matter and Biological Processes in a Subarctic Estuary,
W83-01126 2L

Water Renewal Effects on Reservoir Zooplankton Communities,
W83-01226 2H

Overview of Contaminant Interactions with Surface Films, Zooplankton, and Fish,
W83-01257 5B

Short Cycling of Contaminants by Zooplankton and Their Impact on Great Lakes Ecosystems,
W83-01263 5B

AUTHOR INDEX

ABBI, S. D. S.
Application of Deterministic Conceptual Model for Water Balance Studies,
W83-01387 2A

Application of Sacramento River Forecast Model to an Indian Catchment,
W83-01386 2A

ADAMS, V. D.
Evaluation of Microcosms for Determining the Fate and Effect of Benz(a)anthracene in Aquatic Systems,
W83-01282 5B

ADAMS, W. N.
Microbial Contamination of Continental Shelf Sediments by Wastewater Sludge,
W83-01214 5B

AGARWAL, A. K.
Treatment of Dairy Waste by Flocculating Algael Bacterial System,
W83-01299 5D

AKROYD, J.
Ohiwa Harbour, Natural Values,
W83-01146 6G

ANDERSON, M. G.
The Influence of Low-Angled Topography on Hillslope Soil-Water Convergence and Stream Discharge,
W83-01213 2G

ANDREWS, G. F.
Fluidized-Bed Fermenters: A Steady-State Analysis,
W83-01106 5D

AOWAL, A. F. S. A.
Treatment of Dairy Waste by Flocculating Algael Bacterial System,
W83-01299 5D

Water Hyacinth for Treating Dairy Waste,
W83-01298 5D

APELT, C. J.
New Data on Shape Effects in Smooth Rectangular Channels,
W83-01221 8B

ARITA, T.
Continuous Monitoring of Total and Inorganic Mercury in Wastewater and Other Waters,
W83-01380 5A

ARMSTRONG, D. E.
Trace Metal Accumulation in Surface Microlayers,
W83-01248 5B

ARTHUR, J. W.
Effect of Elevated Water Temperature on Macroinvertebrate Communities in Outdoor Experimental Channels,
W83-01195 5C

ASAY, K. H.
A Greenhouse Line-Source Sprinkler System for Evaluating Plant Response to a Water Application Gradient,
W83-01162 3F

ASHFIELD, G.
Wastewater Tight,
W83-01141 5G

ASTON, S. R.
The Deposition of Windscale Radiocaesium in the Wyre Estuary and the Measurement of Sedimentation Rates,
W83-01138 5B

An Improved Method of Determining Sedimentation Rates by the Use of Artificial Radionuclides,
W83-01153 2J

ATALLAH, Y. H.
Photolysis of Hexachlorocyclopentadiene in Water,
W83-01079 5B

ATSMON, D.
Responses to Water Stress in Wheat and Related Wild Species,
W83-01145 3F

AULIO, K.
Enrichment of Copper, Zinc, Manganese, and Iron in Five Species of Pondweeks (Potamogeton Spp.),
W83-01392 5B

AZIZ, K. M. A.
Epidemiology of Eltor Cholera in Rural Bangladesh: Importance of Surface Water in Transmission,
W83-01107 5C

BADER, M. J.
Radar and Raingauge Observations of Orographic Rain over South Wales,
W83-01061 2B

BADGER, A. C.
Responses of Experimental Estuarine Communities to Continuous Chlorination,
W83-01131 5C

BAIRD, D.
Energy Flow in the Ythan Estuary, Aberdeenshire, Scotland,
W83-01122 2L

BALAKISHIYEVA, B. A.
Chemical Model of Caspian Sea Water,
W83-01251 2K

BALDWIN, G.
Leaching of Cadmium from Pigmented Plastics in a Landfill Site,
W83-01068 5B

BALE, A. J.
Laboratory Simulation of Chemical Processes Induced by Estuarine Mixing: The Behaviour of Iron and Phosphate in Estuaries,
W83-01120 2L

BARBARI, T. A.
Equilibrium Distribution Coefficients for Extraction of Chlorinated Hydrocarbons and Aromatics from Water into Undecane,
W83-01076 5D

BARBER, M. C.
Path Analysis of a Reservoir Ecosystem Model,
W83-01228 6G

BARCELONA, M. J.
Usefulness of Sediment Oxygen as a Tool for Impoundment Management,
W83-01371 5B

BARTHA, R.
Accumulation of the Polychlorinated Biphenyl Aroclor 1242 from Contaminated Detritus and Water by the Saltmarsh Detritivore, UCA Pugnax,
W83-01394 5B

BASAK, P.
Groundwater Buildup and Depletion in Islands During Monsoon and Summer,
W83-01052 2F

Steady Non-Darcy Seepage Through Confined Aquifer of Variable Thickness,
W83-01378 2F

BATHURST, J.
What's in the Water,
W83-01292 5A

BAYLISS-SMITH, T. P.
Velocity Variations in Salt Marsh Creeks, Norfolk, England,
W83-01176 2L

BEARD, K. V.
Raindrop Axial Ratios,
W83-01092 2B

BEATTY, J. S.
Precipitation Data for Burial Grounds 5 and 6, Oak Ridge National Laboratory, Tennessee, 1976-1980,
W83-01183 7C

BECKER, L. D.
Magnitude and Frequency of Floods from Selected Drainage Basins in South Dakota,
W83-01193 4A

BEER, C.
High-Density Use of Septic Systems, Avon Lake, Iowa,
W83-01082 5D

BENDERITTER, Y.
Heat Storage in a Shallow Confined Aquifer: Geophysical Tests to Detect the Resulting Anomaly and Its Evolution with Time,
W83-01205 2F

BENJAMIN, P. M.
Precipitation Data for Burial Grounds 5 and 6, Oak Ridge National Laboratory, Tennessee, 1976-1980,
W83-01183 7C

BENSON, N. G.
Some Observations on the Ecology and Fish Management of Reservoirs in the United States,
W83-01225 6G

BERGE, H.
Correlation Procedures to Reduce Water Losses (Korrelationsverfahren Zur Wasserverlusminderung),
W83-01305 5F

BERKAS, W. R.
Streamflow and Water-Quality Conditions, Wilsons Creek and James River, Springfield Area, Missouri,
W83-01192 4C

BERNHARDT, H.
Water Quality Assurance by Phosphorus Reduction in Drinking Water Reservoirs (Sicherung Der Trinkwassergute Als Folge Von Phosphoreliminierungsmassnahmen and Trinkwassertalsperren),
W83-01114 5F

BEUKES, D. J.
A Field Test of a Conceptual Computer Simulation Model for Predicting Water and Salt Distribution,
W83-01309 2G

BEWTRA, J. K.
Alpha and Beta Factors for Domestic Wastewater,
W83-01207 5D

BHATTACHARYA, P. K.
Diurnal Variation of Rainfall in the Upper Catchments of North Bengal Rivers,
W83-01377 2B

BHATTACHARYYA, S. G.
Diurnal Variation of Rainfall in the Upper Catchments of North Bengal Rivers,
W83-01377 2B

BIERMAN, V. J. JR.
Mass Balance Modeling of DDT Dynamics in Lakes Michigan and Superior,
W83-01069 5B

BINKLEY, D.
Effects of Artificial Conifer Foliage on Collection of Precipitation and Nutrients in Coastal British Columbia,
W83-01218 2I

BISHOP, S. L.
Planning for Droughts,
W83-01347 6D

BLACK, K. B.
Removal of Humic Substances and Turbidity in Water Supply Sources by Polymer Coagulation and Direct Filtration,
W83-01239 5F

BLACK, R. W.
Effectiveness of Septic Systems in Safeguarding the Groundwater in Maine,
W83-01278 5G

BLENNERHASSETT, P. J.
Stability Analysis of Water Movement in Unsaturated Porous Materials. I. Theoretical Considerations,
W83-01200 2G

BOEHMKE, J. R.
Limnology of Mt. Elbert Forebay 1978-79,
W83-01268 2H

BOTO, K. G.
Tidal Export of Particulate Organic Matter from a Northern Australian Mangrove System,
W83-01124 2L

BOVENDEUR, J.
Mobilization of Copper from Modified Peat by Dissolved Organic Matter in Natural Waters and Biologically Purified Wastewaters,
W83-01341 5B

BOWERS, M. R.
Primary Sludge Mass Flow Measurement,
W83-01336 5E

BOWMAN, G. T.
Determination of Total Kjeldahl Nitrogen and Total Phosphorus in Surface Waters and Wastewaters,
W83-01210 5A

BOYCE, J. M.
Epidemiology of Eltor Cholera in Rural Bangladesh: Importance of Surface Water in Transmission,
W83-01107 5C

BOYNE, H. S.
Snow Stratography and Water Equivalence Measured with an Active Microwave System,
W83-01060 2C

BRENGUIER, J. L.
Comparative Study and Calibration of Sensors for the Measurement of the Liquid Water Content of Clouds with Small Droplets,
W83-01091 7B

BRICKER, O.
On the Use of the Nephelometer in Estuarine Waters,
W83-01135 5A

BRIDGE, J. S.
The Dynamics of a River Bend: A Study in Flow and Sedimentary Processes,
W83-01249 2E

BROCK, J. A.
Aeromonas Hydrophila Encountered During Survey of Leptospirae in Prawn Farm Pond Water,
W83-01089 5C

BROWN, E. C.
Legal Issues in Implementing Water Reuse in California,
W83-01074 6E

BROWNING, K. A.
Radar and Raingauge Observations of Orographic Rain over South Wales,
W83-01061 2B

BULL, K. R.
The Distribution of Lead, Zinc and Cadmium in Sediments of an Ore-Enriched Lotic Ecosystem, the River Ecclesbourne, Derbyshire,
W83-01073 5B

BUNT, J. S.
Tidal Export of Particulate Organic Matter from a Northern Australian Mangrove System,
W83-01124 2L

BURRELL, D. C.
Deep Water Renewals and Oxygen Consumption in an Alaskan Fjord,
W83-01119 2L

BUTZ, R. G.
Photolysis of Hexachlorocyclopentadiene in Water,
W83-01079 5B

CABANISS, J. C.
Federal Common Law and its Application to Disputes Involving Accretive and Avulsive Changes in the Bounds of Navigable Waters,
W83-01160 6E

CALANDRO, A. J.
Time of Travel of Solutes in the Vermilion River, Louisiana,
W83-01189 5B

CAMPBELL, K. P.
A Pilot Study of Potential Phenolic Contamination of Fishes in the Columbia River and Tributaries in the Vicinity of Mount St. Helens,
W83-01354 5C

CAPLINS, W. C.
Simulating the Lateral Transport of Ichthyoplankton in the Potomac Estuary,
W83-01136 2L

CAPUANO, R. M.
Fluid-Mineral Equilibria in a Hydrothermal System, Roosevelt Hot Springs, Utah,
W83-01142 2K

CARMACK, E. C.
Patterns of Circulation and Nutrient Supply in a Medium Residence-Time Reservoir Kootenay Lake, British Columbia,
W83-01223 2H

CASEY, M. M.
Reversible and Resistant Components of PCB Adsorption-Desorption: Adsorbent Concentration Effects,
W83-01264 5B

CASWELL, B.
Municipal Fractured-Rock Wells,
W83-01350 3B

CAUSARAS, C. R.
Annotated Bibliography of the Geology and Hydrology of the Surficial Aquifers in Dade, Broward, and Palm Beach Counties, Florida,
W83-01187 10C

CHANG, C. P.
Water Transfer Strategy: Energy Vs. Agricultural Use,
W83-01358 6B

CHARACKLIS, W. G.
Dynamics of Biofilm Processes,
W83-01080 5D

CHASTEEN, N. D.
Chemical Studies of Copper-Organic Complexes Isolated from Estuarine Waters Using C18 Reverse-Phase Liquid Chromatography,
W83-01139 5A

CHATWIN, P. C.
The Effect of Aspect Ratio on Longitudinal Diffusivity in Rectangular Channels,
W83-01115 8B

CHENG, T. C.
Effect of Microbial Life Stages on the Fate of Methylmercury in Natural Waters,
W83-01104 5B

CHESTER, A. J.
Relationships Between Organically Bound Cu Mn in Settling Particulate Matter and Biological Processes in a Subarctic Estuary,
W83-01126 2L

CHEUNG, P-S.
Nitrogen Removal With Rotating Disc System (Stickstoffelimination Mit Dem Tauchtropfkorper),
W83-01323 5D

CHURCH, T. M.
Uranium, Thorium and Lead Nuclides in a Delaware Salt Marsh Sediment,
W83-01123 5B

CLARK, G. B.
Development of a 100,000 GPD Brackish Water Module,
W83-01352 3A

CLARK, I. D.
Isotope Hydrogeology and Geothermometry of the Mount Meager Geothermal Area,
W83-01102 2F

COBLE, K. L.
Combined Sewers: Maintaining Yesterday's Infrastructure with Today's Technology,
W83-01211 5D

COKER, R. D.
Deposition and Chemistry of Pollutant Metals in Lakes Around the Smelters at Sudbury, Ontario,
W83-01078 5B

COLE, D. R.
Fluid-Mineral Equilibria in a Hydrothermal System, Roosevelt Hot Springs, Utah,
W83-01142 2K

COLL, J.
Combined Sewers: Maintaining Yesterday's Infrastructure with Today's Technology,
W83-01211 5D

CONNOLLY, J. P.
Calculated Contribution of Surface Microlayer PCB to Contamination of Lake Michigan Lake Trout,
W83-01258 5B

CONRAD, D. W.
A Study of Well Water in Selected California Communities for Residues of 1,3-Dichloropropene, Chloroallyl Alcohol and 49 Organophosphate or Chlorinated Hydrocarbon Pesticides,
W83-01396 5B

CONSTABLE, G. A.
Irrigation for Crops in a Sub-Humid Environment, I. The Effect of Irrigation on the Growth and Yield of Soybeans,
W83-01288 3F

Irrigation for Crops in a Sub-Humid Environment, II. The Water Requirements of Soybeans,
W83-01314 2I

COOPER, D. I.
Technical Manual for Groundwater Exploration in Arid and Semiarid Regions Using Landsat Visual and Digital Analyses,
W83-01356 7A

COSTERTON, J. W.
Bacterionueston Involved in the Oxidation of Hydrocarbons at the Air-Water Interface,
W83-01247 5B

CRABTREE, R. E.
The Structure of Two South Carolina Estuarine Tide Pool Fish Assemblages,
W83-01137 2L

CRAWFORD, R. L.
Bacterial Enrichments in Surface Films of Freshwater Lakes,
W83-01261 2H

CRONBERG, G.
Changes in the Phytoplankton of Lake Trummen Induced by Restoration,
W83-01159 5G

DATTA, P. S.
A Conceptual Model of Water Transport Through Unsaturated Soil Zone,
W83-01376 2G

DEAN, J. M.
The Structure of Two South Carolina Estuarine Tide Pool Fish Assemblages,
W83-01137 2L

DEATON, D. E.
Canopy Air Temperatures and Evapotranspiration from Irrigated and Stressed Soybeans,
W83-01313 2D

DECATANZARO, J. B.
Effects of Artificial Conifer Foliage on Collection of Precipitation and Nutrients in Coastal British Columbia,
W83-01218 2I

DELAUNE, R. D.
Accumulation of Plant Nutrients and Heavy Metals Through Sedimentation Processes and Accretion in a Louisiana Salt Marsh,
W83-01125 2L

DELFINO, J. J.
Determination of Total Kjeldahl Nitrogen and Total Phosphorus in Surface Waters and Wastewaters,
W83-01210 5A

DELORME, L. D.
Lake Erie Oxygen; The Prehistoric Record,
W83-01231 2H

DETAR, W. R.
Modified Graphical Determination of Submain Size,
W83-01101 8C

DI TORO, D. M.
Reversible and Resistant Components of PCB Adsorption-Desorption: Adsorbent Concentration Effects,
W83-01264 5B

DICKSON, A. G.
Statistical Analysis of Estuarine Profiles: Application to Manganese and Ammonium in the Tamar Estuary,
W83-01154 2L

DICKSON, J. G.
Evaluation of Microcosms for Determining the Fate and Effect of Benz(a)anthracene in Aquatic Systems,
W83-01282 5B

DIGIANO, F. A.
Removal of Humic Substances and Turbidity in Water Supply Sources by Polymer Coagulation and Direct Filtration,
W83-01239 5F

DIMENT, G. A.
Stability Analysis of Water Movement in Unsaturated Porous Materials. I. Theoretical Considerations,
W83-01200 2G

DIXON, K. L.
The Influence of Algal Growth and Other Ecological Factors in Reservoirs on the Production and Control of Trihalomethane Precursors,
W83-01279 5F

DORNBUSH, J. N.
Seepage Ponds to Recycle Municipal Wastewater,
W83-01238 5D

DORRANCE, W. G.
Effects of Residential Wastewater-Treatment Systems on Ground-Water Quality in West-Central Jefferson County, Colorado,
W83-01182 5C

DYMOND, R. L.
Design Considerations for Use of On-Site Sand Filters for Wastewater Treatment,
W83-01368 5D

EADIE, B. J.
Enrichment of PCBs in Lake Michigan Surface Films,
W83-01259 5B

EATON, A.
On the Use of the Nephelometer in Estuarine Waters,
W83-01135 5A

EDMOND, J. M.
Major Ion Chemistry of Some Large Chinese Rivers,
W83-01374 2K

EDMONDS, L. A.
Planning for Droughts,
W83-01347 6D

EGANHOUSE, R. P.
Extractable Organic Matter in Municipal Wastewaters. 2. Hydrocarbons: Molecular Characterization,
W83-01077 5A

EIFERT, W. H.
The Selection of Fishery Parameters for Inclusion in the Stream Reach Inventory and Channel Stability Index,
W83-01364 6G

EISENREICH, S. J.
Atmospheric Role in Trace Metal Exchange at the Air-Water Interface,
W83-01255 5B

Overview of Atmospheric Inputs and Losses from Films,
W83-01246 5B

ELLERBRUCH, D. A.
Snow Stratography and Water Equivalence Measured with an Active Microwave System,
W83-01060 2C

ELLIOT, M.
Mahurangi, Problems of Management,
W83-01168 6G

ELSTER, H-J.
Recent Investigations on the Eutrophication and Restoration of Lake Constance (Neuere Untersuchungen Uber Die Eutrophierung Und Sanierung Des Bodensees),
W83-01321 5G

ELZERMAN, A. W.
Modeling Trace Metals in the Surface Microlayer,
W83-01260 5B

Trace Metal Accumulation in Surface Microlayers,
W83-01248 5B

ENGLISH, M.
Scheduling Irrigation by Computer,
W83-01166 3F

EPPLER, A.
Dam Kleine Kinzig - Design and Construction (Talsperre Kleine Kinzig - Entwurf Und Ausfuhrung),
W83-01110 8D

ERHABOR, P. O.
Efficiency of Resource Use Under Small-Scale Irrigation Technology in Nigeria,
W83-01083 6B

ERICKSEN, G. L.
Effect of Elevated Water Temperature on Macroinvertebrate Communities in Outdoor Experimental Channels,
W83-01195 5C

ERSTFELD, K. M.
Enrichment of PCBs in Lake Michigan Surface Films,
W83-01259 5B

ESTRADA, M.
Phytoplankton Composition and Distribution as an Expression of Properties of Reservoirs,
W83-01224 2H

EVENSON, J. P.
Moisture Stress in Navy Beans. I. Effect of Withholding Irrigation at Different Phenological Stages on Growth and Yield,
W83-01289 3F

EYLES, N.
Geochemical Denudation Rates and Solute Transport Mechanisms in a Maritime Temperate Glacier Basin,
W83-01109 2C

FALVEY, H. T.
Predicting Cavitation in Tunnel Spillways,
W83-01285 8B

FATTARUSSO JR, L. R.
An Economic Evaluation of Interbasin Water Transfers: A Case Study of Southwestern Connecticut,
W83-01271 6C

FEELY, R. A.
Relationships Between Organically Bound Cu Mn in Settling Particulate Matter and Biological Processes in a Subarctic Estuary,
W83-01126 2L

FELICIANO, D. V.
Where We Are But Where Are We Going,
W83-01215 5E

FENWICK, G. D.
Zonation of Inshore Benthos off a Sewage Outfall in Hawke Bay, New Zealand,
W83-01085 5C

FIELD, B.
Structural Analysis of Fouling Community Development in the Damariscotta River Estuary, Maine,
W83-01117 2L

FLYNN, K. C.
Sludge Marketing: The Quiet Revolution,
W83-01208 5E

FOK, Y. S.
Water Transfer Strategy: Energy Vs. Agricultural Use,
W83-01358 6B

FONG, H. R.
A Study of Well Water in Selected California Communities for Residues of 1,3-Dichloropropene, Chloroallyl Alcohol and 49 Organophosphate or Chlorinated Hydrocarbon Pesticides,
W83-01396 5B

FOOTE, M. A.
The Development of Phytoplankton Populations and Nutrients in a Tidal River Under Drought Conditions,
W83-01283 5B

FORBES, R. W.
The Role of Investment Banking Firms in Managing Water Project Financing,
W83-01081 6C

FORSYTH, D. J.
Limnology of Opal Lake,
W83-01116 2H

FREDERICKSON, A. S.
A Study of Well Water in Selected California Communities for Residues of 1,3-Dichloropropene, Chloroallyl Alcohol and 49 Organophosphate or Chlorinated Hydrocarbon Pesticides,
W83-01396 5B

FREESTONE, P.
The Distribution of Lead, Zinc and Cadmium in Sediments of an Ore-Enriched Lotic Ecosystem, the River Ecclesbourne, Derbyshire,
W83-01073 5B

FRENCH, W. J.
Results of Preliminary Experiments on the Influence of Fabrics on the Migration of Groundwater and Water-Soluble Minerals in the Capillary Fringe,
W83-01253 8G

FREY, F.
Construction of the Dam to Supply Potable Water on the 'Kleine Kinzig' River Near Freudenstadt (Bauablauf an Der Trinkwassertalsperre Kleine Kinzig Bei Freudenstadt),
W83-01112 8D

FRIND, E. O.
Simulation of Long-Term Transient Density-Dependent Transport in Groundwater,
W83-01220 2F

FRITZ, P.
Isotope Hydrogeology and Geothermometry of the Mount Meager Geothermal Area,
W83-01102 2F

FROLKIN, D. D.
Stochastic Approach to Evaluating the Effectiveness of Reclamation Measures,
W83-01093 6A

FUHS, G. W.
Microbiota in Surface Films: An Historical Perspective,
W83-01245 5B

Overview of Microbiota in Surface Films,
W83-01265 5B

FUKUI, Y.
Computer Evaluation of Sprinkler Irrigation Uniformity,
W83-01290 3F

GAILEVICH, V. P.
Laboratory Investigations of Methods of Protecting Supports from Local Scour,
W83-01098 8B

GAINES, J.
Microbial Contamination of Continental Shelf Sediments by Wastewater Sludge,
W83-01214 5B

GALASSA, M.
Pathogenic Amoebae in Ocean Sediments Near Wastewater Sludge Disposal Sites,
W83-01216 5C

GARY, H. L.
Stream Water Quality in a Small Commercial Campground in Colorado,
W83-01090 5B

GENDEL'MAN, M. M.
Passage of Floods Over River Floodplains,
W83-01233 2E

GEORGE, D. B.
Evaluation of Microcosms for Determining the Fate and Effect of Benz(a)anthracene in Aquatic Systems,
W83-01282 5B

GEORGIEVSKII, V. YU.
Inflow and Levels of the Caspian Sea and Their Variations Under the Effect of Climatic Factors and Economic Activity,
W83-01094 4A

GERHOLD, R.
Thermophillic and Thermotolerant Fungi Isolated from the Thermal Effluent of Nuclear Power Generating Reactors: Dispersal of Human Opportunistic and Veterinary Pathogenic Fungi,
W83-01375 5C

GHOSH, M. M.
Influence of Particle Size Distribution on Water Quality in Agricultural Impoundments,
W83-01280 5B

GIACOMETTI, A.
Axial Flow-Induced Vibrations in Large High-Head Machines,
W83-01311 8C

GILDING, B. H.
Similarity Solutions of the Porous Media Equation,
W83-01058 2F

GILLESPIE, J. B.
Saline Ground-Water Discharge to the Smoky Hill River Between Salina and Abilene, Central Kansas,
W83-01191 5G

GINN, L. H.
A Weighing Lysimeter for Use in Isolated Field Areas,
W83-01308 2G

GLEISBERG, D.
Precipitation Treatment of Municipal Wastewater with Added Activated Carbon (Fallungsreinigung Von Kommunalem Abwasser Mit Zusatz Von Aktivkohle),
W83-01307 5D

GORDAY, L. L.
The Hydrogeology of Alluvial Aquifers in or Bordering the Dissected Till Plains,
W83-01269 2F

GORDON, S. P.
An Investigation of Psychological Components of Water Conservation Behavior,
W83-01363 3D

Water Resource Management and Conservation for the Future,
W83-01274 3D

GOSAIN, A. K.
Application of Deterministic Conceptual Model for Water Balance Studies,
W83-01387 2A

GOSAIN, S. K.
Application of Sacramento River Forecast Model to an Indian Catchment,
W83-01386 2A

GOTHAM, I. J.
Effects of a Hexachlorobiphenyl and Pentachlorophenol on Growth and Photosynthesis of Phytoplankton,
W83-01242 5C

GOTO, M.
Continuous Monitoring of Total and Inorganic Mercury in Wastewater and Other Waters,
W83-01380 5A

GRAF, D. L.
Chemical Osmosis, Reverse Chemical Osmosis, and the Origin of Subsurface Brines,
W83-01143 2K

GRANT, V.
On the Use of the Nephelometer in Estuarine Waters,
W83-01135 5A

GRAY, C. B. J.
Patterns of Circulation and Nutrient Supply in a Medium Residence-Time Reservoir Kootenay Lake, British Columbia,
W83-01223 2H

GREGOR, D. J.
Simple Trophic State Classification of the Canadian Nearshore Waters of the Great Lakes,
W83-01199 5C

GREGOR, H. P.
Application of Non-Fouling Ultrafiltration Membranes in Water Conversion Technology,
W83-01277 3A

GREGORY, P.
The Dying Estuary,
W83-01291 6G

GUNKEL, R. C. JR.
The Establishment of Water Quality Gradients in Reservoirs,
W83-01222 5B

GUNTON, J. L.
Moisture Stress in Navy Beans. I. Effect of Withholding Irrigation at Different Phenological Stages on Growth and Yield,
W83-01289 3F

GUPTA, R. S.
SRT Technique in Wastewater Process Design,
W83-01297 5D

GUPTA, S. K.
A Conceptual Model of Water Transport Through Unsaturated Soil Zone,
W83-01376 2G

HAGENMAIER, H.
Quantitative Determination of Volatile Halogenated Hydrocarbons in Water Samples by Capillary Gas Chromatography and Electron Capture Detection,
W83-01338 5A

HALL, D. C.
Effects of Residential Wastewater-Treatment Systems on Ground-Water Quality in West-Central Jefferson County, Colorado,
W83-01182 5C

HAMILTON, W. S.
Some Design Factors for the Bath County Trashracks,
W83-01312 8C

HANSON, A. K. JR
Chemical Studies of Copper-Organic Complexes Isolated from Estuarine Waters Using C18 Reverse-Phase Liquid Chromatography,
W83-01139 5A

HANSON, H. M.
The Distribution of Lead, Zinc and Cadmium in Sediments of an Ore-Enriched Lotic Ecosystem, the River Ecclesbourne, Derbyshire,
W83-01073 5B

HANYA, T.
High Abundance of Algal 24-Ethylcholesterol in Antarctic Lake Sediment,
W83-01373 2H

HARGADINE, G. D.
Saline Ground-Water Discharge to the Smoky Hill River Between Salina and Abilene, Central Kansas,
W83-01191 5G

HARLIN, M. M.
Nutrient Enrichment of Seagrass Beds in a Rhode Island Coastal Lagoon,
W83-01129 5C

HAYWARD, R. S.
Spatial Variations in Abundance of Phytoplankton, Zooplankton, and Larval Fishes in Center Hill Reservoir,
W83-01230 2H

HEALEY, R. G.
Velocity Variations in Salt Marsh Creeks, Norfolk, England,
W83-01176 2L

HEARN, A. B.
Irrigation for Crops in a Sub-Humid Environment, I. The Effect of Irrigation on the Growth and Yield of Soybeans,
W83-01288 3F

HEATH, M.
Thermophillic and Thermotolerant Fungi Isolated from the Thermal Effluent of Nuclear Power Generating Reactors: Dispersal of Human Opportunistic and Veterinary Pathogenic Fungi,
W83-01375 5C

HEATHERLY, L. G.
A Weighing Lysimeter for Use in Isolated Field Areas,
W83-01308 2G

HEATWOLE, C.
Environmental Improvement on Narragansett Bay as a Result of Section 312 Implementation of the Federal Water Pollution Control Act,
W83-01130 5G

HEBEL, S. J.
Erosion, Redeposition, and Delivery of Sediment to Midwestern Streams,
W83-01203 4D

HEDDEN, D. M.
Relationships Between Candida Albicans and Traditional Bacterial Indicators of Pollution in Wastewater and Receiving Waters,
W83-01362 5A

HEGGIE, D. T.
Deep Water Renewals and Oxygen Consumption in an Alaskan Fjord,
W83-01119 2L

HEINZ, G.
First Operational Experience at the Wastewater Treatment Facility of the Breisgauer Bucht Wastewater Association (Erste Betriebserfahrungen auf der Klaranlage des Abwasserzweckverbandes Breisgauer Bucht),
W83-01327 5D

HEKMATI, A. M.
Refinement of the Identification and Speciation Schemes of Fecal Streptococci,
W83-01365 5A

HENDRIX, P. F.
Evaluation of a Persulfate Digestion Method for Particulate Nitrogen and Phosphorus,
W83-01196 5A

HIGA, H. H.
Aeromonas Hydrophila Encountered During Survey of Leptospirae in Prawn Farm Pond Water,
W83-01089 5C

HILEMAN, B.
Acid Deposition,
W83-01217 5C

HILL, F. F.
Radar and Raingauge Observations of Orographic Rain over South Wales,
W83-01061 2B

HILLIER, D. E.
Effects of Residential Wastewater-Treatment Systems on Ground-Water Quality in West-Central Jefferson County, Colorado,
W83-01182 5C

HINTON, G. C. F.
Freshwater Red Algae A New Addition to the Iraqi Flora,
W83-01322 2H

Some Diatoms from Brackish Water Habitats in Southern Iraq,
W83-01306 2L

HOEHN, R. C.
The Influence of Algal Growth and Other Ecological Factors in Reservoirs on the Production and Control of Trihalomethane Precursors,
W83-01279 5F

HOLLAND, M. K.
Fences for Floodways,
W83-01148 4A

HORZEMPA, L. M.
Reversible and Resistant Components of PCB Adsorption-Desorption: Adsorbent Concentration Effects,
W83-01264 5B

HUDSON, B. C.
Leaching of Cadmium from Pigmented Plastics in a Landfill Site,
W83-01068 5B

HUDSON, E. J.
The National Development Act and Regional Water Boards,
W83-01167 6E

HUDSON, J. D.
Water-Table Map of the San Jose Well Field and Vicinity, Albuquerque, New Mexico, Spring 1981,
W83-01184 7C

HUGHES, J. M.
Epidemiology of Eltor Cholera in Rural Bangladesh: Importance of Surface Water in Transmission,
W83-01107 5C

HULSEMANN, J.
Dynamics of Mud (Slick) and Suspended Matter in Estuaries. Applicability of By-Products of Surveys of German Coastal Agencies in View of Requirements for Future Needs,
W83-01161 2J

HUTCHINGS, J.
Water to Play With,
W83-01172 6D

ILIEV, S.
Characteristics of a Low-Head Pressure Conduit,
W83-01286 8B

INCZE, L. S.
Stable Density Fronts and Dinoflagellate Patches in a Tidal Estuary,
W83-01121 2L

ISHII, D.
Continuous Monitoring of Total and Inorganic Mercury in Wastewater and Other Waters,
W83-01380 5A

JACKSON, R. E.
Interpretation of pH and Eh Trends in a Fluvial-Sand Aquifer System,
W83-01201 2K

JACOBS, J. A.
Mobilization of Copper from Modified Peat by Dissolved Organic Matter in Natural Waters and Biologically Purified Wastewaters,
W83-01341 5B

JAGER, W.
Quantitative Determination of Volatile Halogenated Hydrocarbons in Water Samples by Capillary Gas Chromatography and Electron Capture Detection,
W83-01338 5A

JAMES, G.
It's all Downhill from Here. The Erewhon Rural Water Supply Scheme,
W83-01170 8A

JAMESON, A. R.
Raindrop Axial Ratios,
W83-01092 2B

JANAKIRAM, K. S.
Erosion of Jets with Cavitation Inducers,
W83-01287 8B

JARVIS, J.
The Dynamics of a River Bend: A Study in Flow and Sedimentary Processes,
W83-01249 2E

JOHNSON, D. A.
A Greenhouse Line-Source Sprinkler System for Evaluating Plant Response to a Water Application Gradient,
W83-01162 3F

JOHNSON, J. A.
Development of New Cleaning Techniques for Reverse Osmosis Membranes,
W83-01369 3A

JOHNSON, L.
Bacterial Enrichments in Surface Films of Freshwater Lakes,
W83-01261 2H

JOHNSON, S. R.
A Pilot Study of Potential Phenolic Contamination of Fishes in the Columbia River and Tributaries in the Vicinity of Mount St. Helens,
W83-01354 5C

JOHNSTON, D. D.
Effect of Suspended Sediment on Feeding by Larval Herring (Clupea Harengus Harengus L.),
W83-01383 5C

JOHNSTON, K.
Wood and Water,
W83-01171 6D

JOINT, I. R.
Primary Production in a Turbid Estuary,
W83-01155 2L

JOSEPHSON, J.
Protecting Public Groundwater Supplies,
W83-01071 5G

JOSHI, D. S.
Removal of Colour in Tertiary Treatment of Sanitary Sewage by Chemical Methods,
W83-01300 5D

KAISER, C. B. JR.
Creation and Operation of the Metropolitan St. Louis Sewer District,
W83-01209 5D

KALCHEV, L.
Characteristics of a Low-Head Pressure Conduit,
W83-01286 8B

KALINOVSKII, A. V.
Dynamics of the Foreshore of a Large Aggradational Feature in the Northwestern Black Sea,
W83-01095 2J

KAPLAN, A. M.
2,4,6-Trinitrotoluene-Surfactant Complexes: Decomposition, Mutagenicity, and Soil Leaching Studies,
W83-01067 5B

KAPLAN, D. L.
2,4,6-Trinitrotoluene-Surfactant Complexes: Decomposition, Mutagenicity, and Soil Leaching Studies,
W83-01067 5B

KAPLAN, I. R.
Extractable Organic Matter in Municipal Wastewaters. 2. Hydrocarbons: Molecular Characterization,
W83-01077 5A

KARTHA, V. C.
Analysis of Freeze-Up Ice Jams on the Peace River Near Taylor, British Columbia,
W83-01103 2C

KATOR, H. I.
In Situ Survival of Enteric Bacteria in Estuarine Environments of Different Nutrient Characteristics,
W83-01281 2L

KAWKA, O. E.
Fractionation of Hydrophobic Origin Materials in Surface Microlayers,
W83-01266 5B

KAZEMIPOUR, A. K.
New Data on Shape Effects in Smooth Rectangular Channels,
W83-01221 8B

KEENHAN, T.
Analysis of Freeze-Up Ice Jams on the Peace River Near Taylor, British Columbia,
W83-01103 2C

KELLER, C. W.
Setting Equitable Water Rates,
W83-01330 6C

KENNEDY, R. H.
The Establishment of Water Quality Gradients in Reservoirs,
W83-01222 5B

KETO, J.
The Recovery of L. Vesijarvi Following Sewage Diversion,
W83-01158 5G

KHAN, M.
Epidemiology of Eltor Cholera in Rural Bangladesh: Importance of Surface Water in Transmission,
W83-01107 5C

KHIABANI, M.
Results of Preliminary Experiments on the Influence of Fabrics on the Migration of Groundwater and Water-Soluble Minerals in the Capillary Fringe,
W83-01253 8G

KHOMITSKII, V. V.
Dynamics of the Foreshore of a Large Aggradational Feature in the Northwestern Black Sea,
W83-01095 2J

KILNER, A.
Ohiwa Harbour, Natural Values,
W83-01146 6G

KING, C. J.
Equilibrium Distribution Coefficients for Extraction of Chlorinated Hydrocarbons and Aromatics from Water into Undecane,
W83-01076 5D

KING, P. T.
Ground Water Geochemistry of 228Ra, 226Ra, and 222Rn,
W83-01157 5A

KINZEL, R.
New Aeration System Cuts Waste Treatment Costs at Badger Paper,
W83-01062 5D

KLAUCKE, D. N.
Acute Fluoride Poisoning Associated with an On-Site Fluoridator in a Vermont Elementary School,
W83-01329 5C

KLEIN, G.
Weak-Electrolyte Ion Exchange in Advanced-Technology Water-Reuse Systems,
W83-01275 5D

KLEINSTREUER, C.
Dynamic Simulator for Anaerobic Digestion Processes,
W83-01105 5D

KNEALE, P. E.
The Influence of Low-Angled Topography on Hillslope Soil-Water Convergence and Stream Discharge,
W83-01213 2G

KNOX, G. A.
The Estuarine Zone, an Overview,
W83-01163 2L

Zonation of Inshore Benthos off a Sewage Outfall in Hawke Bay, New Zealand,
W83-01085 5C

KNOX, S.
Statistical Analysis of Estuarine Profiles: Application to Manganese and Ammonium in the Tamar Estuary,
W83-01154 2L

KOBUKE, Y.
Anionic Surfactant Concentration in the River and Sea Waters of Hyogo Pref. and its Relationship to Phosphorus Concentration, (In Japanese),
W83-01152 5B

KOEPER, J. F.
Combined Sewers: Maintaining Yesterday's Infrastructure with Today's Technology,
W83-01211 5D

KOESTER, H. E.
Ground-Water Quality and Data on Wells and Springs in Pennsylvania, Volume II--Susquehanna and Potomac River Basins,
W83-01186 7C

Ground-Water Quality and Data on Wells and Springs in Pennsylvania, Volume III--Delaware River Basin,
W83-01185 7C

KOTAIAH, B.
Sorption of Phenol by Chemically Treated Flyash,
W83-01296 5D

KRAUSE, R. A.
Spatial Variations in Abundance of Phytoplankton, Zooplankton, and Larval Fishes in Center Hill Reservoir,
W83-01230 2H

KRAUTH, K.
Nitrogen Removal by Means of Preliminary Denitrification (Stickstoffelimination Durch Vorgeschaltete Denitrifikation),
W83-01324 5D

KREEVOY, M. M.
Progress Toward a Solution to the Nitrate Problem,
W83-01072 5F

KRISTENSEN, P.
Time-Dependent Variation of Mercury in a Stream Sediment and the Effect Upon Mercury Content in Gammarus Pulex (L.),
W83-01212 5A

KRISTIANSEN, J.
Chrysophyceae from Some Greek Lakes,
W83-01064 5C

KSHIRSAGAR, S. R.
Removal of Colour in Tertiary Treatment of Sanitary Sewage by Chemical Methods,
W83-01300 5D

KUSHNER, D. J.
Effect of Microbial Life Stages on the Fate of Methylmercury in Natural Waters,
W83-01104 5B

L'VOV, S. N.
Saturated Vapor Pressure of Water and Activity Coefficients of Calcium Chloride in the CaCl2-H20 System at 423-623K,
W83-01250 1A

LAANE, R. W. P. M.
Influence of pH on the Fluorescence of Dissolved Organic Matter,
W83-01128 2L

LABOUNTY, J. F.
Limnology of Mt. Elbert Forebay 1978-79,
W83-01268 2H

LAFOND, J.
Costs of Preventive Maintenance Programs in Wastewater Collection Systems,
W83-01339 5D

LAFORCE, R. W.
Conservation Tillage Effects on Water Conservation,
W83-01240 3F

LAMMELA, W. R.
Chemical Studies of Copper-Organic Complexes Isolated from Estuarine Waters Using C18 Reverse-Phase Liquid Chromatography,
W83-01139 5A

LAMOTTA, E. J.
Removal of Humic Substances and Turbidity in Water Supply Sources by Polymer Coagulation and Direct Filtration,
W83-01239 5F

LANG, T.
Cuba's Zapata Project,
W83-01328 6G

LANGNER, C. L.
Evaluation of a Persulfate Digestion Method for Particulate Nitrogen and Phosphorus,
W83-01196 5A

LARRANCE, J. D.
Relationships Between Organically Bound Cu Mn in Settling Particulate Matter and Biological Processes in a Subarctic Estuary,
W83-01126 2L

LARUE, D.
Acute Fluoride Poisoning Associated with an On-Site Fluoridator in a Vermont Elementary School,
W83-01329 5C

LASKE, C.
Correlation Procedures to Reduce Water Losses (Korrelationsverfahren Zur Wasserverlusminderung),
W83-01305 5F

LAVY, T. L.
Effects of Water on the Fate of Herbicides in Irrigated Soils,
W83-01355 5B

LAWRENCE, J.
Preventing Erosion, Landslip and Flooding, A Planning Approach,
W83-01147 6F

LEAHY, T. M.
Development of New Cleaning Techniques for Reverse Osmosis Membranes,
W83-01369 3A

LEAR, D. W.
Microbial Contamination of Continental Shelf Sediments by Wastewater Sludge,
W83-01214 5B

Pathogenic Amoebae in Ocean Sediments Near Wastewater Sludge Disposal Sites,
W83-01216 5C

LEATHER, D.
Government Announces Policy on Wild Rivers,
W83-01164 6E

Water Demand on the Rakaia,
W83-01315 6D

LEIBFRIED, R. T.
Chemical Interactions Between Forest Soils and Acidic Precipitation During a Dormant Season on Wildcat Run Watershed in Southwestern Pennsylvania,
W83-01236 2K

LEVINE, R. J.
Epidemiology of Eltor Cholera in Rural Bangladesh: Importance of Surface Water in Transmission,
W83-01107 5C

LEWIS, E. J.
Pathogenic Amoebae in Ocean Sediments Near Wastewater Sludge Disposal Sites,
W83-01216 5C

LIDDICOAT, M. I.
Statistical Analysis of Estuarine Profiles: Application to Manganese and Ammonium in the Tamar Estuary,
W83-01154 2L

LIDDLE, M. J.
The Effects of Recreation on Freshwater Plants and Animals: A Review,
W83-01390 5C

LIEBESKING, J.
Costs of Preventive Maintenance Programs in Wastewater Collection Systems,
W83-01339 5D

LIMBURG, P. L.
Desalination-Power Cycles with the Biphase Rotary Separator Turbine, Phase 3,
W83-01370 3A

LINDEMANN, W. C.
Isolation and Control of Membrane Filter Degrading Microorganisms,
W83-01359 3A

LINDSAY, J. M.
Simulating the Lateral Transport of Ichthyoplankton in the Potomac Estuary,
W83-01136 2L

LOCHMOELLER, T.
Influence of Particle Size Distribution on Water Quality in Agricultural Impoundments,
W83-01280 5B

LODENIUS, M.
Recent Increase in Mercury Sedimentation in a Forest Lake Attributable to Peatland Drainage,
W83-01393 5B

LORD, C. J. III
Uranium, Thorium and Lead Nuclides in a Delaware Salt Marsh Sediment,
W83-01123 5B

LOVELAND, R. E.
The Development of Phytoplankton Populations and Nutrients in a Tidal River Under Drought Conditions,
W83-01283 5B

LOWE, J. A.
A Study of Well Water in Selected California Communities for Residues of 1,3-Dichloropropene, Chloroallyl Alcohol and 49 Organophosphate or Chlorinated Hydrocarbon Pesticides,
W83-01396 5B

LUDLAM, S. D.
Use and Limitations of Sedimentary Pigments as Indicators of Past Lake Productivity,
W83-01237 5A

LUTKESTRATKOTTER, H.
Expansion Planning of Water Supply Projects in Tegucigalpa, Honduras (Ausbauplanung Von Wasserversorgungsprojekten in Tegucigalpa, Honduras),
W83-01343 6A

LYATKHER, V. M.
Tensor Structure of the Coefficient of Hydraulic Friction,
W83-01096 8B

MACCHI, G.
The Speciation of Ions in Tiber River Estuary Waters,
W83-01118 5B

MACKAY, D.
Effects of Surface Films on Air-Water Exchange Rates,
W83-01262 5C

MACKENZIE, A. L.
Limnology of Opal Lake,
W83-01116 2H

MADDY, K. T.
A Study of Well Water in Selected California Communities for Residues of 1,3-Dichloropropene, Chloroallyl Alcohol and 49 Organophosphate or Chlorinated Hydrocarbon Pesticides,
W83-01396 5B

MALONE, J. K.
The Influence of Algal Growth and Other Ecological Factors in Reservoirs on the Production and Control of Trihalomethane Precursors,
W83-01279 5F

MALONE, R. F.
An Investigation into the Removal of Algae by Fine Sand/Silt Filtration,
W83-01367 5D

MANCL, K.
High-Density Use of Septic Systems, Avon Lake, Iowa,
W83-01082 5D

MARGALEF, R.
Phytoplankton Composition and Distribution as an Expression of Properties of Reservoirs,
W83-01224 2H

MARINUCCI, A. C.
Accumulation of the Polychlorinated Biphenyl Aroclor 1242 from Contaminated Detritus and Water by the Saltmarsh Detritivore, UCA Pugnax,
W83-01394 5B

MARSHALL, W. N.
Funding Improvements with Debt Capital and Revenues,
W83-01055 6C

MARTIN, E. A.
210Pb Geochronology and Trace Metal Concentrations of Sediments from Upper Klamath Lake and Lake Euwana, Oregon,
W83-01252 2J

MARTINSON, M.
Bacterial Enrichments in Surface Films of Freshwater Lakes,
W83-01261 2H

MASON, W. K.
Irrigation for Crops in a Sub-Humid Environment, II. The Water Requirements of Soybeans,
W83-01314 2I

MATSUMOTO, G.
High Abundance of Algal 24-Ethylcholesterol in Antarctic Lake Sediment,
W83-01373 2H

MATUZENKO, M. YU.
Saturated Vapor Pressure of Water and Activity Coefficients of Calcium Chloride in the CaCl2-H20 System at 423-623K,
W83-01250 1A

MAULOOD, B. K.
Freshwater Red Algae A New Addition to the Iraqi Flora,
W83-01322 2H

Some Diatoms from Brackish Water Habitats in Southern Iraq,
W83-01306 2L

MAYORAL, M. L.
Responses to Water Stress in Wheat and Related Wild Species,
W83-01145 3F

MCCRAY, K.
Pitless Equipment,
W83-01349 5F

Supreme Court Issues Groundwater Rights Ruling,
W83-01337 6E

MCFADZEAN, C. J.
Operational Experiences with a Pulsator Clarifier Treating a Coloured Upland Water,
W83-01302 5F

MCGREER, E. R.
Factors Affecting the Distribution of the Bivalve, Macoma Balthica (L.) on a Mudflat Receiving Sewage Effluent, Fraser River Estuary, British Columbia,
W83-01127 5C

MCKENZIE, L. R.
The Effects of Mining Southland Lignite on Water and Soil Resources,
W83-01151 6G

MCMICHAEL, B. L.
A Weighing Lysimeter for Use in Isolated Field Areas,
W83-01308 2G

MCNAUGHT, D. C.
Overview of Contaminant Interactions with Surface Films, Zooplankton, and Fish,
W83-01257 5B

Short Cycling of Contaminants by Zooplankton and Their Impact on Great Lakes Ecosystems,
W83-01263 5B

MEYERS, P. A.
Fractionation of Hydrophobic Origin Materials in Surface Microlayers,
W83-01266 5B

MIAN, A. A.
Heavy Metal Concentrations in Shrimp, Crab, and Sediment Obtained from Ad-Dammam Sewage Outfall Area,
W83-01391 5B

MICHEL, F. A.
Isotope Hydrogeology and Geothermometry of the Mount Meager Geothermal Area,
W83-01102 2F

MICHEL, J.
Ground Water Geochemistry of 228Ra, 226Ra, and 222Rn,
W83-01157 5A

MIKHAILOVA, N. A.
Laboratory Investigations of Methods of Protecting Supports from Local Scour,
W83-01098 8B

MILLER, D. R.
Ground-Water Quality and Data on Wells and Springs in Pennsylvania, Volume II--Susquehanna and Potomac River Basins,
W83-01186 7C

Ground-Water Quality and Data on Wells and Springs in Pennsylvania, Volume III--Delaware River Basin,
W83-01185 7C

MILLER, R. L.
Water-Quality and Hydrogeologic Data for Three Phosphate Industry Waste-Disposal Sites in Central Florida, 1979-80,
W83-01190 7C

MILLERO, F. J.
The Speciation of Ions in Tiber River Estuary Waters,
W83-01118 5B

MILLS, G. L.
Chemical Studies of Copper-Organic Complexes Isolated from Estuarine Waters Using C18 Reverse-Phase Liquid Chromatography,
W83-01139 5A

MILNE, H.
Energy Flow in the Ythan Estuary, Aberdeenshire, Scotland,
W83-01122 2L

MILNE-HOME, W. A.
Watersheds in Muskeg Terrain. 1. The Chemistry of Water Systems,
W83-01206 2K

MING-HUI, H.
Major Ion Chemistry of Some Large Chinese Rivers,
W83-01374 2K

MIR, M.
Phytoplankton Composition and Distribution as an Expression of Properties of Reservoirs,
W83-01224 2H

MITCHELL, C.
Grass Carp and Water Weed,
W83-01173 4A

MONTE, J. A.
Technical Manual for Groundwater Exploration in Arid and Semiarid Regions Using Landsat Visual and Digital Analyses,
W83-01356 7A

MOOLMAN, J. H.
A Field Test of a Conceptual Computer Simulation Model for Predicting Water and Salt Distribution,
W83-01309 2G

MOORE, I. D.
The Influence of Atmospheric Nitrogen Influx Upon the Stream Nitrogen Profile of a Relatively Undisturbed Forested Watershed,
W83-01059 5B

MOORE, J. W.
Water Quality Considerations in the Slurry Pipelining of Coal,
W83-01273 5B

MOORE, W. S.
Ground Water Geochemistry of 228Ra, 226Ra, and 222Rn,
W83-01157 5A

MORIARTY, F.
The Distribution of Lead, Zinc and Cadmium in Sediments of an Ore-Enriched Lotic Ecosystem, the River Ecclesbourne, Derbyshire,
W83-01073 5B

MORRIS, A. W.
Laboratory Simulation of Chemical Processes Induced by Estuarine Mixing: The Behaviour of Iron and Phosphate in Estuaries,
W83-01120 2L

MORRIS, C. J.
Organic Contaminants in Groundwater Near an Underground Coal Gasification Site in Northeastern Wyoming,
W83-01066 5B

MORRISON, K.
Simulation of Fish Movements in a Large Hydro-Electric Reservoir: LG-2,
W83-01229 6G

MOTOMIZU, S.
Spectrophotometric Determination of Aluminum in River Water with Bromopyrogallol Red and n-Tetradecyltrimethylammonium Bromide by Flow Injection Analysis,
W83-01389 5A

MOWRY, B. A.
Treatment Technology to Meet the Drinking Water Standards for Trihalomethanes for Jackson, Mississippi,
W83-01360 5F

MULYUKOVA, N. B.
Laboratory Investigations of Methods of Protecting Supports from Local Scour,
W83-01098 8B

MUSGRAVE, D. L.
Density-Driven Interstitial Water Motion in Sediments,
W83-01372 2H

NAGHAVI, B.
An Investigation into the Removal of Algae by Fine Sand/Silt Filtration,
W83-01367 5D

NAKANISHI, K.
Computer Evaluation of Sprinkler Irrigation Uniformity,
W83-01290 3F

NARAYANAN, P.
Application of Deterministic Conceptual Model for Water Balance Studies,
W83-01387 2A

NARAYANASWAMY, M. S.
River Water Quality for Bathing Purposes,
W83-01320 5C

NASSER, M. S.
Dynamic Equations for Steady Spatially Varied Open Channel Flow: A Critical Review,
W83-01395 8B

NAU-RITTER, G. M.
Field and Laboratory Studies of the Toxicity of Phytoplankton of Polychlorinated Biphenyls (PCBs) Desorbed from Fine Clays and Natural Suspended Particulates,
W83-01244 5C

NEELY, W. B.
The Definition and Use of Mixing Zones,
W83-01070 5G

NELSON, C. S.
Sedimentation in an Artificial Lake - Lake Matahina, Bay of Plenty,
W83-01084 2J

NETSCH, H.
Axial Flow-Induced Vibrations in Large High-Head Machines,
W83-01311 8C

NEUMANN, J.
Construction of the Dam to Supply Potable Water on the 'Kleine Kinzig' River Near Freudenstadt (Bauablauf an Der Trinkwassertalsperre Kleine Kinzig Bei Freudenstadt),
W83-01112 8D

NG, D. J.
Organic Contaminants in Groundwater Near an Underground Coal Gasification Site in Northeastern Wyoming,
W83-01066 5B

NICKUM, E.
Effects of Residential Wastewater-Treatment Systems on Ground-Water Quality in West-Central Jefferson County, Colorado,
W83-01182 5C

NIGAM, J. P.
Infiltration Well Used In Hardwar Water Supply,
W83-01301 6B

NIKOLIC, S.
Influence of Kinetics on the Direct Titration Curves of Natural Water Systems - Theoretical Considerations,
W83-01388 5A

NITSCHE, C. I.
Progress Toward a Solution to the Nitrate Problem,
W83-01072 5F

NOONE, G. P.
Process Design of Anaerobic Sludge Digestion,
W83-01353 5D

NRIAGU, J. O.
Deposition and Chemistry of Pollutant Metals in Lakes Around the Smelters at Sudbury, Ontario,
W83-01078 5B

NUCKOLS, J. R.
The Influence of Atmospheric Nitrogen Influx Upon the Stream Nitrogen Profile of a Relatively Undisturbed Forested Watershed,
W83-01059 5B

NUNES, R. A.
The Tidal Instrusion Front: An Estuarine Convergence Zone,
W83-01177 2L

O'MALLEY, M. L.
Microbial Contamination of Continental Shelf Sediments by Wastewater Sludge,
W83-01214 5B

Pathogenic Amoebae in Ocean Sediments Near Wastewater Sludge Disposal Sites,
W83-01216 5C

OKAMURA, S.
Computer Evaluation of Sprinkler Irrigation Uniformity,
W83-01290 3F

OVERCASH, M. R.
Fate of Polychlorinated Biphenyls (PCBs) in Soil Plant Systems,
W83-01235 5B

PADOVANI, M. A.
Presence of Enteric Microorganisms in the Air Environment at Wastewater Treatment Plants in Puerto Rico,
W83-01272 5D

PAERL, H. W.
Environmental Factors Promoting and Regulating N2 Fixing Blue-Green Algal Blooms in the Chowan River, NC,
W83-01357 5C

PAL, D.
Fate of Polychlorinated Biphenyls (PCBs) in Soil Plant Systems,
W83-01235 5B

PALMER, M. D.
Potential Eutrophication of the Rideau River by an Urban Waterway: Discussion,
W83-01219 5C

PANIN, G. M.
Surface Layers of Air and Water and their Role in Heat and Moisture Exchange Between a Water Body and the Atmosphere,
W83-01113 2D

PANU, U. S.
Analysis of Freeze-Up Ice Jams on the Peace River Near Taylor, British Columbia,
W83-01103 2C

PARSONS, J. E.
Canopy Air Temperatures and Evapotranspiration from Irrigated and Stressed Soybeans,
W83-01313 2D

PATRICK, W. H. JR.
Accumulation of Plant Nutrients and Heavy Metals Through Sedimentation Processes and Accretion in a Louisiana Salt Marsh,
W83-01125 2L

PATTEN, B. C.
Path Analysis of a Reservoir Ecosystem Model,
W83-01228 6G

PATTERSON, R. J.
Interpretation of pH and Eh Trends in a Fluvial-Sand Aquifer System,
W83-01201 2K

PAULSEN, O.
A Microprocessor Controlled System for Storm Water Sampling (Ein Mikroprozessor-Gesteurtes System Zur Probennahme Aus Regeneasserkanalen),
W83-01342 7A

PAULSON, A. J.
Relationships Between Organically Bound Cu Mn in Settling Particulate Matter and Biological Processes in a Subarctic Estuary,
W83-01126 2L

PEARSON, T. H.
The Loch Eil Project: Assessment and Synthesis with a Discussion of Certain Biological Questions Arising from a Study of the Organic Pollution of Sediments,
W83-01086 5C

PERRI, S. F.
Aeromonas Hydrophila Encountered During Survey of Leptospirae in Prawn Farm Pond Water,
W83-01089 5C

PERRY, W. B.
Algal Growth Stimulus by Phosphorus in Flathead Lake, Montana, Sediments,
W83-01065 5C

PERSONNE, P.
Comparative Study and Calibration of Sensors for the Measurement of the Liquid Water Content of Clouds with Small Droplets,
W83-01091 7B

PETERS, T. L.
Comparison of Continuous Extractors for the Extraction and Concentration of Trace Organics from Water,
W83-01381 5A

PETROSYAN, O. P.
Laboratory Investigation of the Structure of the Flow and Bottom Features in River Mouth Regions,
W83-01099 2E

PETTINE, M.
The Speciation of Ions in Tiber River Estuary Waters,
W83-01118 5B

PFEIFFER, R.
Experience Report for Decentralized Wastewater Treatment (Erfahrungsbericht Mit Der Dezentralen Abwasserreinigung),
W83-01326 5D

PHAMWON, S.
Network Model for Optimal Management of Stream-Aquifer Systems,
W83-01366 4B

PHILLIPS, C. J.
Sedimentation in an Artificial Lake - Lake Matahina, Bay of Plenty,
W83-01084 2J

PINTY, J. P.
Comparative Study and Calibration of Sensors for the Measurement of the Liquid Water Content of Clouds with Small Droplets,
W83-01091 7B

PLATFORD, R. F.
Pesticide Partitioning in Artificial Surface Films,
W83-01256 5B

POINTIN, Y.
Comparative Study and Calibration of Sensors for the Measurement of the Liquid Water Content of Clouds with Small Droplets,
W83-01091 7B

POLGAR, T. T.
Simulating the Lateral Transport of Ichthyoplankton in the Potomac Estuary,
W83-01136 2L

POMROY, A. J.
Primary Production in a Turbid Estuary,
W83-01155 2L

PONOMARENKO, V. G.
Laboratory Investigation of the Structure of the Flow and Bottom Features in River Mouth Regions,
W83-01099 2E

POOLE, A. B.
Results of Preliminary Experiments on the Influence of Fabrics on the Migration of Groundwater and Water-Soluble Minerals in the Capillary Fringe,
W83-01253 8G

POWEIGHA, T.
Dynamic Simulator for Anaerobic Digestion Processes,
W83-01105 5D

POWERS, C. D.
Field and Laboratory Studies of the Toxicity of Phytoplankton of Polychlorinated Biphenyls (PCBs) Desorbed from Fine Clays and Natural Suspended Particulates,
W83-01244 5C

POWERS, T. M.
Water Resource Management and Conservation for the Future,
W83-01274 3D

PRASAD, K.
An Operational Key Station Network for the Sone Catchment,
W83-01384 7A

PRENDIVILLE, P. W.
The U.S.: Rethinking Filtration and Disinfection,
W83-01331 5F

PYE, K.
Velocity Variations in Salt Marsh Creeks, Norfolk, England,
W83-01176 2L

QUINN, J. G.
Chemical Studies of Copper-Organic Complexes Isolated from Estuarine Waters Using C18 Reverse-Phase Liquid Chromatography,
W83-01139 5A

RAE, J. E.
The Deposition of Windscale Radiocaesium in the Wyre Estuary and the Measurement of Sedimentation Rates,
W83-01138 5B

RAMAMOORTHY, S.
Effect of Microbial Life Stages on the Fate of Methylmercury in Natural Waters,
W83-01104 5B

RAMAMURTHY, A. S.
Dynamic Equations for Steady Spatially Varied Open Channel Flow: A Critical Review,
W83-01395 8B

RAMGOLAM, R.
A Pricing Policy for Groundwater Management in Puerto Rico,
W83-01276 6C

RAMPRASAD, G.
Sorption of Phenol by Chemically Treated Flyash,
W83-01296 5D

RANDALI, C. W.
The Influence of Algal Growth and Other Ecological Factors in Reservoirs on the Production and Control of Trihalomethane Precursors,
W83-01279 5F

RAO, A. R.
Statistical Characteristics of Some Indian Hydrologic Time Series,
W83-01385 2E

RASHIDOVA, T. N.
Chemical Model of Caspian Sea Water,
W83-01251 2K

RAST, W.
Simple Trophic State Classification of the Canadian Nearshore Waters of the Great Lakes,
W83-01199 5C

RAVENSCROFT, P.
Results of Preliminary Experiments on the Influence of Fabrics on the Migration of Groundwater and Water-Soluble Minerals in the Capillary Fringe,
W83-01253 8G

READ, G.
Opinion,
W83-01346 5G

REDDY, C. N.
Accumulation of Plant Nutrients and Heavy Metals Through Sedimentation Processes and Accretion in a Louisiana Salt Marsh,
W83-01125 2L

REEBURGH, W. S.
Density-Driven Interstitial Water Motion in Sediments,
W83-01372 2H

REED, T. B.
Map of Water Table in Solomon River Valley, Waconda Lake to Solomon, North-Central Kansas, May 1980,
W83-01180 7C

REICOSKY, D. C.
Canopy Air Temperatures and Evapotranspiration from Irrigated and Stressed Soybeans,
W83-01313 2D

RHEE, G. Y.
Effects of a Hexachlorobiphenyl and Pentachlorophenol on Growth and Photosynthesis of Phytoplankton,
W83-01242 5C

Overview of Phytoplankton Contaminant Problems,
W83-01243 5B

RHODES, M. W.
In Situ Survival of Enteric Bacteria in Estuarine Environments of Different Nutrient Characteristics,
W83-01281 2L

RICE, C. A.
210Pb Geochronology and Trace Metal Concentrations of Sediments from Upper Klamath Lake and Lake Euwana, Oregon,
W83-01252 2J

RICE, C. P.
Enrichment of PCBs in Lake Michigan Surface Films,
W83-01259 5B

RICHARDSON, T. H.
Path Analysis of a Reservoir Ecosystem Model,
W83-01228 6G

RICHARDSON, W.
Reversible and Resistant Components of PCB Adsorption-Desorption: Adsorbent Concentration Effects,
W83-01264 5B

RIEGLER, G.
Optimized Energy Exploitation through Aerobic-Anaerobic Two-Phase Stabilization (Optimierte Energieausnutzung Durch die Aerob-Anaerob Zweiphasen-Stabilisation),
W83-01304 5D

RINEHART, D. N.
A Greenhouse Line-Source Sprinkler System for Evaluating Plant Response to a Water Application Gradient,
W83-01162 3F

RIOS, R. A.
A Pricing Policy for Groundwater Management in Puerto Rico,
W83-01276 6C

RIPPON, J. W.
Thermophillic and Thermotolerant Fungi Isolated from the Thermal Effluent of Nuclear Power Generating Reactors: Dispersal of Human Opportunistic and Veterinary Pathogenic Fungi,
W83-01375 5C

ROGERSON, R. J.
Geochemical Denudation Rates and Solute Transport Mechanisms in a Maritime Temperate Glacier Basin,
W83-01109 2C

ROHDE, F. G.
Expansion Planning of Water Supply Projects in Tegucigalpa, Honduras (Ausbauplanung Von Wasserversorgungsprojekten in Tegucigalpa, Honduras),
W83-01343 6A

ROLINE, R. A.
Limnology of Mt. Elbert Forebay 1978-79,
W83-01268 2H

ROVENER, D.
Desalination-Power Cycles with the Biphase Rotary Separator Turbine, Phase 3,
W83-01370 3A

ROWLAND, R. G.
Field and Laboratory Studies of the Toxicity of Phytoplankton of Polychlorinated Biphenyls (PCBs) Desorbed from Fine Clays and Natural Suspended Particulates,
W83-01244 5C

RUMBAUGH, M. D.
A Greenhouse Line-Source Sprinkler System for Evaluating Plant Response to a Water Application Gradient,
W83-01162 3F

RUSHTON, K. R.
An Assessment of the Importance of Some Parameters for Seawater Intrusion in Aquifers and a Comparison of Dispersive and Sharp-Interface Modelling Approaches,
W83-01051 2F

RUZIC, I.
Influence of Kinetics on the Direct Titration Curves of Natural Water Systems - Theoretical Considerations,
W83-01388 5A

SADASIVAN, S.
Variation of Trace Element Concentration in Rainwater with Rainfall Rate and Rainfall Amount,
W83-01379 5A

SADIQ, M.
Heavy Metal Concentrations in Shrimp, Crab, and Sediment Obtained from Ad-Dammam Sewage Outfall Area,
W83-01391 5B

SAENZ, T. W.
Cuba's Zapata Project,
W83-01328 6G

SAGAR, G.
Low Cost Technology for Disposal of Human Excreta with Community Latrines,
W83-01319 5D

SALIN, M.
Enrichment of Copper, Zinc, Manganese, and Iron in Five Species of Pondweeks (Potamogeton Spp.),
W83-01392 5B

SALTER, T. D.
Effluent--A Question of Sludge,
W83-01334 5E

SARTORIS, J. J.
Limnology of Mt. Elbert Forebay 1978-79,
W83-01268 2H

SASSEVILLE, D. R.
Geochemical Denudation Rates and Solute Transport Mechanisms in a Maritime Temperate Glacier Basin,
W83-01109 2C

SATO, V. T.
Aeromonas Hydrophila Encountered During Survey of Leptospirae in Prawn Farm Pond Water,
W83-01089 5C

SAVIN , K. D.
Laboratory Investigations of Methods of Protecting Supports from Local Scour,
W83-01098 8B

SAWA, T. R.
Aeromonas Hydrophila Encountered During Survey of Leptospirae in Prawn Farm Pond Water,
W83-01089 5C

SAWYER, T. K.
Microbial Contamination of Continental Shelf Sediments by Wastewater Sludge,
W83-01214 5B

Pathogenic Amoebae in Ocean Sediments Near Wastewater Sludge Disposal Sites,
W83-01216 5C

SCHMIDT, J. A.
Models of Particle Dry Deposition to a Lake Surface and Some Effects of Surface Microlayers,
W83-01267 5B

SCHOCK, M. R.
Effect of Container Type on pH and Alkalinity Stability,
W83-01197 5A

SCHOCK, S. C.
Effect of Container Type on pH and Alkalinity Stability,
W83-01197 5A

SCHWARTZ, F. W.
Watersheds in Muskeg Terrain. 1. The Chemistry of Water Systems,
W83-01206 2K

SCORGIE, H. R. A.
The Effects of Recreation on Freshwater Plants and Animals: A Review,
W83-01390 5C

SCOTT, W. S.
An Analysis of Factors Influencing De-Icing Salt Levels in Streams,
W83-01088 5B

SELEBA, G. S.
Financial Planning During Times of Economic Uncertainty,
W83-01054 6C

SHARMA, S. C.
A Conceptual Model of Water Transport Through Unsaturated Soil Zone,
W83-01376 2G

SHAW, D.
More or Less Water,
W83-01317 6G

SHERIDAN, P. F.
Responses of Experimental Estuarine Communities to Continuous Chlorination,
W83-01131 5C

SHIBAKAWA, T.
Continuous Monitoring of Total and Inorganic Mercury in Wastewater and Other Waters,
W83-01380 5A

SHIEH, W. K.
Mass Transfer in a Rotating Biological Contractor,
W83-01198 5D

SHIH, S. F.
Rainfall Variation Analysis and Optimization of Gaging Systems,
W83-01202 2B

SHIKLOMANOV, I. A.
Inflow and Levels of the Caspian Sea and Their Variations Under the Effect of Climatic Factors and Economic Activity,
W83-01094 4A

SHIMSHI, D.
Responses to Water Stress in Wheat and Related Wild Species,
W83-01145 3F

SHKOL'NIKOV, S. YA.
Tensor Structure of the Coefficient of Hydraulic Friction,
W83-01096 8B

SIHORWALA, T. A.
Removal of Colour in Tertiary Treatment of Sanitary Sewage by Chemical Methods,
W83-01300 5D

SIMOLA, H.
Recent Increase in Mercury Sedimentation in a Forest Lake Attributable to Peatland Drainage,
W83-01393 5B

SIMPSON, J. H.
The Tidal Instrusion Front: An Estuarine Convergence Zone,
W83-01177 2L

SINGH, J.
Water Hyacinth for Treating Dairy Waste,
W83-01298 5D

SINKOVIC, J.
Weak-Electrolyte Ion Exchange in Advanced-Technology Water-Reuse Systems,
W83-01275 5D

SKOPINTSEV, B. A.
Decolorization of Infiltration Water Under Natural Conditions,
W83-01097 2F

SLATT, R. M.
Geochemical Denudation Rates and Solute Transport Mechanisms in a Maritime Temperate Glacier Basin,
W83-01109 2C

SMITH, F. J.
Water Resource Management and Conservation for the Future,
W83-01274 3D

SMITH, L.
Environmental Improvement on Narragansett Bay as a Result of Section 312 Implementation of the Federal Water Pollution Control Act,
W83-01130 5G

SMITH, R. C. G.
Irrigation for Crops in a Sub-Humid Environment, II. The Water Requirements of Soybeans,
W83-01314 2I

SMITH, R. F.
Modernizing Irrigation Systems in Alberta,
W83-01232 4A

SMITH, T. J.
Mathematical Model for Partially Mixed Estuaries Using the Turbulence Energy Equation,
W83-01133 2L

SNODGRASS, W. J.
Mathematical Model for Dissolved Oxygen in Three Southern Ontario Reservoirs,
W83-01227 5B

SOKOL'NIKOV, YU. N.
Dynamics of the Foreshore of a Large Aggradational Feature in the Northwestern Black Sea,
W83-01095 2J

SOMAYAJULU, B. L. K.
Uranium, Thorium and Lead Nuclides in a Delaware Salt Marsh Sediment,
W83-01123 5B

SONI, J. P.
Steady Non-Darcy Seepage Through Confined Aquifer of Variable Thickness,
W83-01378 2F

SOUTHER, J. G.
Isotope Hydrogeology and Geothermometry of the Mount Meager Geothermal Area,
W83-01102 2F

SPALL, J. G.
The Onflow of Irrigation Schemes,
W83-01318 3B

SPELLANE, J.
New Aeration System Cuts Waste Treatment Costs at Badger Paper,
W83-01062 5D

SPELLS, A. J.
Spatial Variations in Abundance of Phytoplankton, Zooplankton, and Larval Fishes in Center Hill Reservoir,
W83-01230 2H

SPINAZOLA, J. M.
Hydrologic Maps of the Ogallala Aquifer, West-Central Kansas, 1979-81,
W83-01188 7C

Map of Water Table in Graham County, Northwestern Kansas, March 1979,
W83-01181 7C

STAAB, K. F.
Nitrogen Removal by Means of Preliminary Denitrification (Stickstoffelimination Durch Vorgeschaltete Denitrifikation),
W83-01324 5D

STALLARD, R. F.
Major Ion Chemistry of Some Large Chinese Rivers,
W83-01374 2K

STANFORD, J. A.
Algal Growth Stimulus by Phosphorus in Flathead Lake, Montana, Sediments,
W83-01065 5C

STANNERS, D. A.
An Improved Method of Determining Sedimentation Rates by the Use of Artificial Radionuclides,
W83-01153 2J

STARR, F. C.
The Role of Investment Banking Firms in Managing Water Project Financing,
W83-01081 6C

STEICHEN, J. M.
Conservation Tillage Effects on Water Conservation,
W83-01240 3F

STEPHENSON, R.
Avon-Heathcote, Estuary Under Stress,
W83-01149 5B

STEPUNIN, P. M.
Laboratory Investigations of Methods of Protecting Supports from Local Scour,
W83-01098 8B

STIGEBRANDT, A.
Mechanism Governing the Estuarine Circulation in Deep, Strongly Stratified Fjords,
W83-01132 2L

STODDART, D. R.
Velocity Variations in Salt Marsh Creeks, Norfolk, England,
W83-01176 2L

STRUCHTEMEYER, R. A.
Effectiveness of Septic Systems in Safeguarding the Groundwater in Maine,
W83-01278 5G

STUERMER, D. H.
Organic Contaminants in Groundwater Near an Underground Coal Gasification Site in Northeastern Wyoming,
W83-01066 5B

SUCKLING, F. E. T.
The Te Awa Research: 35 Years of Soil Conservation,
W83-01169 4D

SULLIVAN, P. J.
The Effect of Aspect Ratio on Longitudinal Diffusivity in Rectangular Channels,
W83-01115 8B

SUTCLIFFE JR, H.
Water-Quality and Hydrogeologic Data for Three Phosphate Industry Waste-Disposal Sites in Central Florida, 1979-80,
W83-01190 7C

SUZUKI, S.
Adsorption and Desorption of Heavy Metals in Bottom Mud of Urban Rivers,
W83-01194 5B

Distributions of Heavy Metals in Bottom Mud and Polygonum Nodosum in the Watarase River (In Japanese),
W83-01175 5B

SWAIN, W. R.
Mass Balance Modeling of DDT Dynamics in Lakes Michigan and Superior,
W83-01069 5B

SWEETEN, J. M.
Sedimental Journey,
W83-01140 5E

SYAMALA RAO, B. C.
Erosion of Jets with Cavitation Inducers,
W83-01287 8B

TABBAGH, J.
Heat Storage in a Shallow Confined Aquifer: Geophysical Tests to Detect the Resulting Anomaly and Its Evolution with Time,
W83-01205 2F

TADA, F.
Adsorption and Desorption of Heavy Metals in Bottom Mud of Urban Rivers,
W83-01194 5B

Distributions of Heavy Metals in Bottom Mud and Polygonum Nodosum in the Watarase River (In Japanese),
W83-01175 5B

TAKHAR, H. S.
Mathematical Model for Partially Mixed Estuaries Using the Turbulence Energy Equation,
W83-01133 2L

TEIRNEY, L.
Tutira, A Lake Worth Restoring,
W83-01165 5G

TETT, P.
The Loch Eil Project: Planktonic Pigments in Sediments From Loch Eil and the Firth of Lorne,
W83-01087 5C

TEWARI, P. K.
Alpha and Beta Factors for Domestic Wastewater,
W83-01207 5D

THEAKSTONE, W. H.
Sediment Fans and Sediment Flows Generated by Snowmelt: Observations at Austerdalsisen, Norway,
W83-01254 2J

THERIEN, N.
Simulation of Fish Movements in a Large Hydro-Electric Reservoir: LG-2,
W83-01229 6G

THIESSEN, J. W.
Modernizing Irrigation Systems in Alberta,
W83-01232 4A

THOMANN, R. V.
Calculated Contribution of Surface Microlayer PCB to Contamination of Lake Michigan Lake Trout,
W83-01258 5B

THOMAS, R. H.
Hydrotec - A Geotextile Water Well Screen,
W83-01345 5F

THOMSON, L. J.
What's in the Water,
W83-01292 5A

THORNE-MILLER, B.
Nutrient Enrichment of Seagrass Beds in a Rhode Island Coastal Lagoon,
W83-01129 5C

THORNTON, K. W.
The Establishment of Water Quality Gradients in Reservoirs,
W83-01222 5B

THRELKELD, S. T.
Water Renewal Effects on Reservoir Zooplankton Communities,
W83-01226 2H

THUT, A.
Measuring Station to Determine Pore Water Pressure - Zervreila Arch Dam (Messanlage Fur Porenwasserduck - Bogenstaumauer Zervreila),
W83-01100 8G

TOEI, K.
Spectrophotometric Determination of Aluminum in River Water with Bromopyrogallol Red and n-Tetradecyltrimethylammonium Bromide by Flow Injection Analysis,
W83-01389 5A

TOMLINSON, A. I.
High Intensity Rainfalls in NZ,
W83-01295 2B

TORII, T.
High Abundance of Algal 24-Ethylcholesterol in Antarctic Lake Sediment,
W83-01373 2H

TRANUM, W. M.
Precipitation Data for Burial Grounds 5 and 6, Oak Ridge National Laboratory, Tennessee, 1976-1980,
W83-01183 7C

TRULEAR, M. G.
Dynamics of Biofilm Processes,
W83-01080 5D

TSAITTS, E. S.
Dynamics of the Foreshore of a Large Aggradational Feature in the Northwestern Black Sea,
W83-01095 2J

TUCKEY, W. J.
The Effects of Mining Southland Lignite on Water and Soil Resources,
W83-01151 6G

TULLIS, J. P.
Some Design Factors for the Bath County Trashracks,
W83-01312 8C

TURNER, D. R.
Statistical Analysis of Estuarine Profiles: Application to Mangancse and Ammonium in the Tamar Estuary,
W83-01154 2L

UL-HODA, A.
Heavy Metal Concentrations in Shrimp, Crab, and Sediment Obtained from Ad-Dammam Sewage Outfall Area,
W83-01391 5B

ULANOWICZ, R. E.
Simulating the Lateral Transport of Ichthyoplankton in the Potomac Estuary,
W83-01136 2L

UNCLES, R. J.
A Note on Tidal Asymmetry in the Severn Estuary,
W83-01134 2L

VAN BUUREN, J. C. L.
Mobilization of Copper from Modified Peat by Dissolved Organic Matter in Natural Waters and Biologically Purified Wastewaters,
W83-01341 5B

VAN DEN AVYLE, M. J.
Spatial Variations in Abundance of Phytoplankton, Zooplankton, and Larval Fishes in Center Hill Reservoir,
W83-01230 2H

VAN STADEN, J. F.
Automated Prevalve Sample Filtration in Flow Injection Analysis: Determination of Sulphate in Water Removing Suspended Solids and Colour Before Sampling,
W83-01303 5A

VANDENBERG, A.
An Alternative Conceptual Model of Groundwater Flow,
W83-01204 2F

VANSICKLE, J.
Stochastic Predictions of Sediment Yields from Small Coastal Watersheds in Oregon, U.S.A.,
W83-01053 2J

VENEMAN, P. L. M.
The Septic Tank as a Wastewater Treatment and Disposal Facility,
W83-01241 5D

VENKATARAMAN, P.
Dynamic Equations for Steady Spatially Varied Open Channel Flow: A Critical Review,
W83-01395 8B

VERMEULEN, T.
Weak-Electrolyte Ion Exchange in Advanced-Technology Water-Reuse Systems,
W83-01275 5D

VERWORN, H-R.
A Microprocessor Controlled System for Storm Water Sampling (Ein Mikroprozessor-Gesteurtes System Zur Probennahme Aus Regeneasserkanalen),
W83-01342 7A

VOGT, R. L.
Acute Fluoride Poisoning Associated with an On-Site Fluoridator in a Vermont Elementary School,
W83-01329 5C

VOLKER, R. E.
An Assessment of the Importance of Some Parameters for Seawater Intrusion in Aquifers and a Comparison of Dispersive and Sharp-Interface Modelling Approaches,
W83-01051 2F

WADA, Y.
Distributions of Heavy Metals in Bottom Mud and Polygonum Nodosum in the Watarase River (In Japanese),
W83-01175 5B

WAGNER, F.
Causes, Prevention and Control of Bulking Sludge in Activated Sludge Plants (Ursachen, Verhinderung Und Bekampfung Der Blahschlammbildung in Belebungsanlagen),
W83-01325 5D

WAGNER, G.
The Reconstruction of the Schlichem Barrage Near Schomberg in the Zollernalb District (Die Sanierung Der Schlichemtalsperre Bei Schomberg in Zollernalbkreis),
W83-01111 8D

WALSH, E.
Desalination-Power Cycles with the Biphase Rotary Separator Turbine, Phase 3,
W83-01370 3A

WALTERS, R. A.
Low-Frequency Variations in Sea Level and Currents in South San Francisco Bay,
W83-01057 2L

WANG, W.
Usefulness of Sediment Oxygen as a Tool for Impoundment Management,
W83-01371 5B

WANGEN, L. E.
Control by Alkaline Neutralization of Trace Elements in Acidic Coal Cleaning Waste Leachates,
W83-01075 5G

WATSON, K. K.
Stability Analysis of Water Movement in Unsaturated Porous Materials. I. Theoretical Considerations,
W83-01200 2G

WATSON, N.
A Water Right for Fisheries,
W83-01293 6E

WEBER, J. B.
Fate of Polychlorinated Biphenyls (PCBs) in Soil Plant Systems,
W83-01235 5B

WEBSTER, D. A.
Precipitation Data for Burial Grounds 5 and 6, Oak Ridge National Laboratory, Tennessee, 1976-1980,
W83-01183 7C

WEINSTOCK, N.
Legal Issues in Implementing Water Reuse in California,
W83-01074 6E

WELLS, D.
On the Use of the Nephelometer in Estuarine Waters,
W83-01135 5A

WERNER, G.
Quantitative Determination of Volatile Halogenated Hydrocarbons in Water Samples by Capillary Gas Chromatography and Electron Capture Detection,
W83-01338 5A

WEST, N.
Environmental Improvement on Narragansett Bay as a Result of Section 312 Implementation of the Federal Water Pollution Control Act,
W83-01130 5G

WHITEHILL, T. J.
Evaluation of the Use of Iodine for Disinfection of Effluent from On-Site 'Package' Wastewater Treatment Systems,
W83-01361 5D

WHITFIELD, M.
Statistical Analysis of Estuarine Profiles: Application to Manganese and Ammonium in the Tamar Estuary,
W83-01154 2L

WILDISH, D. J.
Effect of Suspended Sediment on Feeding by Larval Herring (Clupea Harengus Harengus L.),
W83-01383 5C

WILKIN, D. C.
Erosion, Redeposition, and Delivery of Sediment to Midwestern Streams,
W83-01203 4D

WILKINSON, L. F.
What's in the Water,
W83-01292 5A

WILLARDSON, L. S.
A Greenhouse Line-Source Sprinkler System for Evaluating Plant Response to a Water Application Gradient,
W83-01162 3F

WILLIAMS, J. M.
Control by Alkaline Neutralization of Trace Elements in Acidic Coal Cleaning Waste Leachates,
W83-01075 5G

WILLIAMS, P. C.
Creative Financing Techniques for Water Utilities,
W83-01056 6C

WILSON, D. C.
Leaching of Cadmium from Pigmented Plastics in a Landfill Site,
W83-01068 5B

WITHERELL, L.
Acute Fluoride Poisoning Associated with an On-Site Fluoridator in a Vermont Elementary School,
W83-01329 5C

WOLNIAKOWSKI, K. U.
A Pilot Study of Potential Phenolic Contamination of Fishes in the Columbia River and Tributaries in the Vicinity of Mount St. Helens,
W83-01354 5C

WOLVERTON, G.
Water Regulations,
W83-01144 6E

WONG, H. K. T.
Deposition and Chemistry of Pollutant Metals in Lakes Around the Smelters at Sudbury, Ontario,
W83-01078 5B

WURSTER, C. F.
Field and Laboratory Studies of the Toxicity of Phytoplankton of Polychlorinated Biphenyls (PCBs) Desorbed from Fine Clays and Natural Suspended Particulates,
W83-01244 5C

WYGANOWSKI, C.
Spectrophotometric Determination of Aluminum in River Water with Bromopyrogallol Red and n-Tetradecyltrimethylammonium Bromide by Flow Injection Analysis,
W83-01389 5A

WYNDHAM, R. C.
Bacterionueston Involved in the Oxidation of Hydrocarbons at the Air-Water Interface,
W83-01247 5B

YACUBSON, S.
The Phytoplankton of Some Freshwater Bodies from Zulia State (Venezuela),
W83-01063 2H

YENTSCH, C. M.
Stable Density Fronts and Dinoflagellate Patches in a Tidal Estuary,
W83-01121 2L

YOUNG, K.
Soil Conservation Protects the Trout,
W83-01294 4D

YOUNG, P. J.
Leaching of Cadmium from Pigmented Plastics in a Landfill Site,
W83-01068 5B

YU, C. C.
Photolysis of Hexachlorocyclopentadiene in Water,
W83-01079 5B

YU KORNEV, P.
Kurpsai Hydroelectric Station on the Naryn River,
W83-01234 8A

ZAIDI, T. H.
Heavy Metal Concentrations in Shrimp, Crab, and Sediment Obtained from Ad-Dammam Sewage Outfall Area,
W83-01391 5B

ZALTSBERG, E.
Application of Statistical Methods to Forecasting of Natural Groundwater Tables,
W83-01108 4B

ZANELLA, E. F.
Shifts in Caddisfly Species Composition in Sacramento River Invertebrate Communities in the Presence of Heavy Metal Contamination,
W83-01382 5C

ZAPATA-MORENO, M. C.
Removal of Humic Substances and Turbidity in Water Supply Sources by Polymer Coagulation and Direct Filtration,
W83-01239 5F

ZAREMBO, V. I.
Saturated Vapor Pressure of Water and Activity Coefficients of Calcium Chloride in the CaCl2-H20 System at 423-623K,
W83-01250 1A

ZHANG, Y-Z.
Direct Solution for Uniform Flows in Elliptical Channels,
W83-01284 8B

ZISCHKE, J. A.
Effect of Elevated Water Temperature on Macroinvertebrate Communities in Outdoor Experimental Channels,
W83-01195 5C

ORGANIZATIONAL INDEX

AARHUS UNIV. (DENMARK). ZOOLOGISK INST.
Time-Dependent Variation of Mercury in a Stream Sediment and the Effect Upon Mercury Content in Gammarus Pulex (L.),
W83-01212 5A

AGRICULTURAL RESEARCH AND EDUCATION CENTER, BELLE GLADE, FL. DEPT. OF AGRICULTURAL ENGINEERING.
Rainfall Variation Analysis and Optimization of Gaging Systems,
W83-01202 2B

AGRICULTURAL RESEARCH ORGANIZATION, BET-DAGAN (ISRAEL). INST. OF SOILS AND WATER.
Responses to Water Stress in Wheat and Related Wild Species,
W83-01145 3F

AGRICULTURAL UNIV., WAGENINGEN (NETHERLANDS). DEPT. OF WATER POLLUTION CONTROL.
Mobilization of Copper from Modified Peat by Dissolved Organic Matter in Natural Waters and Biologically Purified Wastewaters,
W83-01341 5B

AKADEMIYA NAUK AZERBAIDZHANSKOI SSR, BAKU.
Chemical Model of Caspian Sea Water,
W83-01251 2K

AKADEMIYA NAUK SSSR, MOSCOW. FIZIKO-TEKHNICHESKII INST.
Stochastic Approach to Evaluating the Effectiveness of Reclamation Measures,
W83-01093 6A

AKADEMIYA NAUK SSSR, MOSCOW. INST. BIOLOGII VNUTRENNYKH VOD.
Decolorization of Infiltration Water Under Natural Conditions,
W83-01097 2F

AKADEMIYA NAUK SSSR, MOSCOW. INST. VODNYKH PROBLEM.
Surface Layers of Air and Water and their Role in Heat and Moisture Exchange Between a Water Body and the Atmosphere,
W83-01113 2D

ALASKA UNIV., FAIRBANKS. INST. OF MARINE SCIENCE.
Deep Water Renewals and Oxygen Consumption in an Alaskan Fjord,
W83-01119 2L

Density-Driven Interstitial Water Motion in Sediments,
W83-01372 2H

ALBERTA ENVIRONMENTAL CENTER, VEGREVILLE.
Effect of Microbial Life Stages on the Fate of Methylmercury in Natural Waters,
W83-01104 5B

ALBERTA UNIV., EDMONTON. DEPT. OF GEOLOGY.
Watersheds in Muskeg Terrain. 1. The Chemistry of Water Systems,
W83-01206 2K

ALL-UNION DESIGNING, SURVEYING AND SCIENTIFIC RESEARCH INST., MOSCOW (USSR).
Tensor Structure of the Coefficient of Hydraulic Friction,
W83-01096 8B

ARIZONA UNIV., TUCSON. SCHOOL OF RENEWABLE NATURAL RESOURCES.
Erosion, Redeposition, and Delivery of Sediment to Midwestern Streams,
W83-01203 4D

ARKANSAS UNIV., FAYETTEVILLE. DEPT. OF AGRONOMY.
Effects of Water on the Fate of Herbicides in Irrigated Soils,
W83-01355 5B

ARKANSAS UNIV., FAYETTEVILLE. DEPT. OF CIVIL ENGINEERING.
Water Quality Considerations in the Slurry Pipelining of Coal,
W83-01273 5B

ARMY ENGINEER WATERWAYS EXPERIMENT STATION, VICKSBURG, MS.
The Establishment of Water Quality Gradients in Reservoirs,
W83-01222 5B

ARMY NATICK RESEARCH AND DEVELOPMENT LAB., MA.
2,4,6-Trinitrotoluene-Surfactant Complexes: Decomposition, Mutagenicity, and Soil Leaching Studies,
W83-01067 5B

AUSTRALIAN INST. OF MARINE SCIENCES., TOWNSVILLE.
Tidal Export of Particulate Organic Matter from a Northern Australian Mangrove System,
W83-01124 2L

BADGER PAPER MILLS, INC., PESHTIGO, WI.
New Aeration System Cuts Waste Treatment Costs at Badger Paper,
W83-01062 5D

BARCELONA UNIV. (SPAIN). DEPT. OF ECOLOGIA.
Phytoplankton Composition and Distribution as an Expression of Properties of Reservoirs,
W83-01224 2H

BEAK CONSULTANTS, INC., PORTLAND, OR.
A Pilot Study of Potential Phenolic Contamination of Fishes in the Columbia River and Tributaries in the Vicinity of Mount St. Helens,
W83-01354 5C

BENARAS HINDU UNIV., VARANASI (INDIA). INST. OF TECH.
River Water Quality for Bathing Purposes,
W83-01320 5C

BHABBA ATOMIC RESEARCH CENTER, BOMBAY (INDIA). AIR MONITORING SECTION.
Variation of Trace Element Concentration in Rainwater with Rainfall Rate and Rainfall Amount,
W83-01379 5A

BIPHASE ENERGY SYSTEMS, SANTA MONICA, CA.
Desalination-Power Cycles with the Biphase Rotary Separator Turbine, Phase 3,
W83-01370 3A

BLACK AND VEATCH, KANSAS CITY, MO.
Setting Equitable Water Rates,
W83-01330 6C

BRISTOL UNIV. (ENGLAND). DEPT. OF GEOGRAPHY.
The Influence of Low-Angled Topography on Hillslope Soil-Water Convergence and Stream Discharge,
W83-01213 2G

BRITISH COLUMBIA HYDRO AND POWER AUTHORITY, VANCOUVER. HYDROELECTRIC GENERATION PROJECTS DIV.
Analysis of Freeze-Up Ice Jams on the Peace River Near Taylor, British Columbia,
W83-01103 2C

BUREAU OF RECLAMATION, DENVER, CO.
Predicting Cavitation in Tunnel Spillways,
W83-01285 8B

BUREAU OF RECLAMATION, DENVER, CO. ENGINEERING AND RESEARCH CENTER.
Limnology of Mt. Elbert Forebay 1978-79,
W83-01268 2H

BURNS AND MCDONNELL, KANSAS CITY, MO.
Funding Improvements with Debt Capital and Revenues,
W83-01055 6C

BURNS AND ROE INDUSTRIAL SERVICES CORP., PARAMUS, NJ.
Costs of Preventive Maintenance Programs in Wastewater Collection Systems,
W83-01339 5D

CALGARY UNIV., (ALBERTA). DEPT. OF BIOLOGY.
Bacterionueston Involved in the Oxidation of Hydrocarbons at the Air-Water Interface,
W83-01247 5B

CALIFORNIA DEPT. OF FOOD AND AGRICULTURE, SACRAMENTO.
A Study of Well Water in Selected California Communities for Residues of 1,3-Dichloropropene, Chloroallyl Alcohol and 49 Organophosphate or Chlorinated Hydrocarbon Pesticides,
W83-01396 5B

CALIFORNIA UNIV., BERKELEY.
Legal Issues in Implementing Water Reuse in California,
W83-01074 6E

CALIFORNIA UNIV., BERKELEY. DEPT. OF CHEMICAL ENGINEERING.
Equilibrium Distribution Coefficients for Extraction of Chlorinated Hydrocarbons and Aromatics from Water into Undecane,
W83-01076 5D

CALIFORNIA UNIV., BERKELEY. WATER THERMAL AND CHEMICAL TECHNOLOGY CENTER.
Weak-Electrolyte Ion Exchange in Advanced-Technology Water-Reuse Systems,
W83-01275 5D

CALIFORNIA UNIV., LOS ANGELES. DEPT. OF EARTH AND SPACE SCIENCES.
Extractable Organic Matter in Municipal Wastewaters. 2. Hydrocarbons: Molecular Characterization,
W83-01077 5A

CAMP, DRESSER AND MCKEE, INC., BOSTON, MA.
The U.S.: Rethinking Filtration and Disinfection,
W83-01331 5F

CANADA CENTER FOR INLAND WATERS, BURLINGTON (ONTARIO).
Pesticide Partitioning in Artificial Surface Films,
W83-01256 5B

CANADA CENTRE FOR INLAND WATER, BURLINGTON (ONTARIO).
Simple Trophic State Classification of the Canadian Nearshore Waters of the Great Lakes,
W83-01199 5C

CANTERBURY UNIV., CHRISTCHURCH (NEW ZEALAND). DEPT. OF ZOOLOGY.
Zonation of Inshore Benthos off a Sewage Outfall in Hawke Bay, New Zealand,
W83-01085 5C

Avon-Heathcote, Estuary Under Stress,
W83-01149 5B

CANTERBURY UNIV., CHRISTCHURCH (NEW ZEALAND). DEPT. OF ZOOLOGY.

The Estuarine Zone, an Overview,
W83-01163 2L

CENTER FOR WATER RESOURCES DEVELOPMENT AND MANAGEMENT, CALCUTTA (INDIA). GROUNDWATER DIV.
Groundwater Buildup and Depletion in Islands During Monsoon and Summer,
W83-01052 2F

CENTER FOR WATER RESOURCES DEVELOPMENT AND MANAGEMENT, CALICUT (INDIA).
Steady Non-Darcy Seepage Through Confined Aquifer of Variable Thickness,
W83-01378 2F

CENTERS FOR DISEASE CONTROL, ATLANTA, GA.
Epidemiology of Eltor Cholera in Rural Bangladesh: Importance of Surface Water in Transmission,
W83-01107 5C

CENTRE NATIONAL DE LA REHERCHE SCIENTIFIQUE, POUILLY SUR LOIRE (FRANCE). CENTRE DE RECHERCHES GEOPHYSIQUES.
Heat Storage in a Shallow Confined Aquifer: Geophysical Tests to Detect the Resulting Anomaly and Its Evolution with Time,
W83-01205 2F

CHANGCHUN GEOLOGY COLL. (CHINA). DEPT. OF HYDROLOGIC GEOLOGY AND ENGINEERING GEOLOGY.
Direct Solution for Uniform Flows in Elliptical Channels,
W83-01284 8B

CHICAGO UNIV., IL. DEPT. OF MEDICINE.
Thermophillic and Thermotolerant Fungi Isolated from the Thermal Effluent of Nuclear Power Generating Reactors: Dispersal of Human Opportunistic and Veterinary Pathogenic Fungi,
W83-01375 5C

CLEMSON UNIV., SC. DEPT. OF ENVIRONMENTAL SYSTEMS ENGINEERING.
Modeling Trace Metals in the Surface Microlayer,
W83-01260 5B

CLERMONT UNIV., AUBIERE (FRANCE).
Comparative Study and Calibration of Sensors for the Measurement of the Liquid Water Content of Clouds with Small Droplets,
W83-01091 7B

COLLEGE OF PETROLEUM AND MINERALS, DHAHRAN (SAUDI ARABIA). RESEARCH INST.
Heavy Metal Concentrations in Shrimp, Crab, and Sediment Obtained from Ad-Dammam Sewage Outfall Area,
W83-01391 5B

COLORADO STATE UNIV., FORT COLLINS. DEPT. OF CIVIL ENGINEERING.
Network Model for Optimal Management of Stream-Aquifer Systems,
W83-01366 4B

COMMONWEALTH SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANIZATION, CANBERRA (AUSTRALIA). DIV. OF PLANT INDUSTRY.
Irrigation for Crops in a Sub-Humid Environment, I. The Effect of Irrigation on the Growth and Yield of Soybeans,
W83-01288 3F

CONNECTICUT UNIV., STORRS. INST. OF WATER RESOURCES.
Relationships Between Candida Albicans and Traditional Bacterial Indicators of Pollution in Wastewater and Receiving Waters,
W83-01362 5A

CONNECTICUT UNIV., STORRS. INSTI. OF WATER RESOURCES.
An Economic Evaluation of Interbasin Water Transfers: A Case Study of Southwestern Connecticut,
W83-01271 6C

COPENHAGEN UNIV. (DENMARK). INST. OF PLANT ANATOMY AND CYTOLOGY.
Chrysophyceae from Some Greek Lakes,
W83-01064 5C

DELAWARE UNIV., NEWARK. COLL. OF MARINE STUDIES.
Uranium, Thorium and Lead Nuclides in a Delaware Salt Marsh Sediment,
W83-01123 5B

DELHI COLL. OF ENGINEERING (INDIA).
Water Hyacinth for Treating Dairy Waste,
W83-01298 5D

Treatment of Dairy Waste by Flocculating Algael Bacterial System,
W83-01299 5D

DEPARTMENT OF FISHERIES AND OCEANS, ST. ANDREWS (NEW BRUNSWICK).
Effect of Suspended Sediment on Feeding by Larval Herring (Clupea Harengus Harengus L.),
W83-01383 5C

DEPARTMENT OF SCIENCE AND TECHNOLOGY, NEW DELHI (INDIA).
Erosion of Jets with Cavitation Inducers,
W83-01287 8B

DEPARTMENT OF THE ENVIRONMENT, EDMONTON (ALBERTA). DIV. OF DESIGN AND CONSTRUCTION.
Modernizing Irrigation Systems in Alberta,
W83-01232 4A

DEPARTMENT OF THE ENVIRONMENT, OTTAWA (ONTARIO). INLAND WATERS DIRECTORATE.
Interpretation of pH and Eh Trends in a Fluvial-Sand Aquifer System,
W83-01201 2K

DEUTSCHES HYDROGRAPHISCHES INST., HAMBURG (GERMANY, F.R.).
Dynamics of Mud (Slick) and Suspended Matter in Estuaries. Applicability of By-Products of Surveys of German Coastal Agencies in View of Requirements for Future Needs,
W83-01161 2J

DOW CHEMICAL CO., MIDLAND, MI.
The Definition and Use of Mixing Zones,
W83-01070 5G

Comparison of Continuous Extractors for the Extraction and Concentration of Trace Organics from Water,
W83-01381 5A

DOW CHEMICAL CO., WALNUT CREEK, CA.
Development of New Cleaning Techniques for Reverse Osmosis Membranes,
W83-01369 3A

DOW CHEMICAL CO., WALNUT CREEK, CA. WESTERN DIV.
Development of a 100,000 GPD Brackish Water Module,
W83-01352 3A

DUNSTAFFNAGE MARINE RESEARCH LAB., OBAN (SCOTLAND).
The Loch Eil Project: Assessment and Synthesis with a Discussion of Certain Biological Questions Arising from a Study of the Organic Pollution of Sediments,
W83-01086 5C

The Loch Eil Project: Planktonic Pigments in Sediments From Loch Eil and the Firth of Lorne,
W83-01087 5C

E.V.S. CONSULTANTS LTD., VANCOUVER (BRITISH COLUMBIA).
Factors Affecting the Distribution of the Bivalve, Macoma Balthica (L.) on a Mudflat Receiving Sewage Effluent, Fraser River Estuary, British Columbia,
W83-01127 5C

ECONOMIC AND ENGINEERING SERVICES, INC., BELLEVUE, WA.
Financial Planning During Times of Economic Uncertainty,
W83-01054 6C

EDINBURGH UNIV. (SCOTLAND). DEPT. OF GEOGRAPHY.
Velocity Variations in Salt Marsh Creeks, Norfolk, England,
W83-01176 2L

EG AND G ENVIRONMENTAL CONSULTANTS, INC., WALTHAM, MA.
Structural Analysis of Fouling Community Development in the Damariscotta River Estuary, Maine,
W83-01117 2L

ENVIRONMENTAL PROTECTION AGENCY, ANNAPOLIS, MD.
Microbial Contamination of Continental Shelf Sediments by Wastewater Sludge,
W83-01214 5B

ENVIRONMENTAL PROTECTION AGENCY, MONTICELLO, MN. ECOLOGICAL RESEARCH STATION.
Effect of Elevated Water Temperature on Macroinvertebrate Communities in Outdoor Experimental Channels,
W83-01195 5C

ENVIRONMENTAL RESEARCH LAB.-DULUTH, GROSSE ILE, MI. LARGE LAKES RESEARCH STATION.
Mass Balance Modeling of DDT Dynamics in Lakes Michigan and Superior,
W83-01069 5B

ENVIRONMENTAL RESEARCH LAB., JOHN'S ISLAND, SC. BEARS BLUFF FIELD STATION.
Responses of Experimental Estuarine Communities to Continuous Chlorination,
W83-01131 5C

EXXON RESEARCH AND ENGINEERING CO., FLORHAM PARK, NJ.
Mass Transfer in a Rotating Biological Contractor,
W83-01198 5D

FENG CHIA COLL. OF ENGINEERING AND BUSINESS, TAICHUNG (TAIWAN).
Nitrogen Removal With Rotating Disc System (Stickstoffelimination Mit Dem Tauchtropfkorper),
W83-01323 5D

FISH AND WILDLIFE SERVICE, SLIDELL, LA.
Some Observations on the Ecology and Fish Management of Reservoirs in the United States,
W83-01225 6G

FLOOD METEOROLOGICAL OFFICE, JALPAIGURI (INDIA).
Diurnal Variation of Rainfall in the Upper Catchments of North Bengal Rivers,
W83-01377 2B

FLOOD METEOROLOGICAL OFFICE, PATNA (INDIA).
An Operational Key Station Network for the Sone Catchment,
W83-01384 7A

FRIENDS OF THE EARTH, NELSON (NEW ZEALAND).
More or Less Water,
W83-01317 6G

GEOLOGICAL SURVEY, ALBUQUERQUE, NM. WATER RESOURCES DIV.
Water-Table Map of the San Jose Well Field and Vicinity, Albuquerque, New Mexico, Spring 1981,
W83-01184 7C

GEOLOGICAL SURVEY, BATON ROUGE, LA. WATER RESOURCES DIV.
Time of Travel of Solutes in the Vermilion River, Louisiana,
W83-01189 5B

GEOLOGICAL SURVEY, CORPUS CHRISTI, TX.
210Pb Geochronology and Trace Metal Concentrations of Sediments from Upper Klamath Lake and Lake Euwana, Oregon,
W83-01252 2J

GEOLOGICAL SURVEY, GARDEN CITY, KS. WATER RESOURCES DIV.
Map of Water Table in Graham County, Northwestern Kansas, March 1979,
W83-01181 7C

Hydrologic Maps of the Ogallala Aquifer, West-Central Kansas, 1979-81,
W83-01188 7C

GEOLOGICAL SURVEY, HARRISBURG, PA. WATER RESOURCES DIV.
Ground-Water Quality and Data on Wells and Springs in Pennsylvania, Volume III--Delaware River Basin,
W83-01185 7C

Ground-Water Quality and Data on Wells and Springs in Pennsylvania, Volume II--Susquehanna and Potomac River Basins,
W83-01186 7C

GEOLOGICAL SURVEY, HURON, SD. WATER RESOURCES DIV.
Magnitude and Frequency of Floods from Selected Drainage Basins in South Dakota,
W83-01193 4A

GEOLOGICAL SURVEY, KNOXVILLE, TN. WATER RESOURCES DIV.
Precipitation Data for Burial Grounds 5 and 6, Oak Ridge National Laboratory, Tennessee, 1976-1980,
W83-01183 7C

GEOLOGICAL SURVEY, LAKEWOOD, CO. WATER RESOURCES DIV.
Effects of Residential Wastewater-Treatment Systems on Ground-Water Quality in West-Central Jefferson County, Colorado,
W83-01182 5C

GEOLOGICAL SURVEY, LAWRENCE, KS. WATER RESOURCES DIV.
Map of Water Table in Solomon River Valley, Waconda Lake to Solomon, North-Central Kansas, May 1980,
W83-01180 7C

Saline Ground-Water Discharge to the Smoky Hill River Between Salina and Abilene, Central Kansas,
W83-01191 5G

GEOLOGICAL SURVEY, MENLO PARK, CA.
Low-Frequency Variations in Sea Level and Currents in South San Francisco Bay,
W83-01057 2L

GEOLOGICAL SURVEY, RICHMOND, VA. WATER RESOURCES DIV.
Water Resources Data, Virginia, Water Year 1981.
W83-01179 7C

GEOLOGICAL SURVEY, ROLLA, MO. WATER RESOURCES DIV.
Streamflow and Water-Quality Conditions, Wilsons Creek and James River, Springfield Area, Missouri,
W83-01192 4C

GEOLOGICAL SURVEY, SALT LAKE CITY, WATER RESOURCES DIV.
Water Resources Data, Utah, Water Year 1981.
W83-01178 7C

GEOLOGICAL SURVEY, ST. PAUL, MN. WATER RESOURCES DIV.
Water Resources Data, Minnesota, Water Year 1981. Volume 2. Upper Mississippi and Missouri River Basins.
W83-01397 7C

Water Resources Data, Minnesota, Water Year 1981. Volume 1. Great Lakes and Souris-Red-Rainy River Basins.
W83-01398 7C

GEOLOGICAL SURVEY, TALLAHASSEE, FL. WATER RESOURCES DIV.
Annotated Bibliography of the Geology and Hydrology of the Surficial Aquifers in Dade, Broward, and Palm Beach Counties, Florida,
W83-01187 10C

Water-Quality and Hydrogeologic Data for Three Phosphate Industry Waste-Disposal Sites in Central Florida, 1979-80,
W83-01190 7C

GEOLOGICAL SURVEY, URBANA, IL. WATER RESOURCES DIV.
Water Resources Data, Illinois, Water Year 1981. Volume 2. Illinois River Basin.
W83-01399 7C

Water Resources Data, Illinois, Water Year 1981. Volume 1. Illinois Except Illinois River Basin.
W83-01400 7C

GEORGIA UNIV., ATHENS.
Spatial Variations in Abundance of Phytoplankton, Zooplankton, and Larval Fishes in Center Hill Reservoir,
W83-01230 2H

GEORGIA UNIV., ATHENS, INST. OF ECOLOGY.
Evaluation of a Persulfate Digestion Method for Particulate Nitrogen and Phosphorus,
W83-01196 5A

Path Analysis of a Reservoir Ecosystem Model,
W83-01228 6G

GOETEBORG UNIV. (SWEDEN). DEPT. OF OCEANOGRAPHY.
Mechanism Governing the Estuarine Circulation in Deep, Strongly Stratified Fjords,
W83-01132 2L

GORE AND STORRIE LTD., TORONTO (ONTARIO).
Potential Eutrophication of the Rideau River by an Urban Waterway: Discussion,
W83-01219 5C

GREENHORNE AND O'MARA, INC., RIVERDALE, MD.
Technical Manual for Groundwater Exploration in Arid and Semiarid Regions Using Landsat Visual and Digital Analyses,
W83-01356 7A

GRIFFITH UNIV., NATHAN (AUSTRALIA). SCHOOL OF AUSTRALIAN ENVIRONMENTAL STUDIES.
The Effects of Recreation on Freshwater Plants and Animals: A Review,
W83-01390 5C

HANOVER UNIV. (GERMANY, F.R.). INST. FUER WASSERWIRTSCHAFT, HYDROLOGIE UND LANDWIRTSCHAFTLICHEN WASSERBAU.
A Microprocessor Controlled System for Storm Water Sampling (Ein Mikroprozessor-Gesteurtes System Zur Probennahme Aus Regeneasserkanalen),
W83-01342 7A

HARWELL LAB., OXON (ENGLAND).
Leaching of Cadmium from Pigmented Plastics in a Landfill Site,
W83-01068 5B

HARZA ENGINEERING CO., CHICAGO, IL.
Some Design Factors for the Bath County Trashracks,
W83-01312 8C

HAWAII STATE DEPT. OF HEALTH, HONOLULU.
Aeromonas Hydrophila Encountered During Survey of Leptospirae in Prawn Farm Pond Water,
W83-01089 5C

HAWAII UNIV. AT MANOA, HONOLULU. WATER RESOURCES RESEARCH CENTER.
Water Transfer Strategy: Energy Vs. Agricultural Use,
W83-01358 6B

HOECHST A.G., HUERTH/KNAPSACK (GERMANY, F. R.).
Precipitation Treatment of Municipal Wastewater with Added Activated Carbon (Fallungsreinigung Von Kommunalem Abwasser Mit Zusatz Von Aktivkohle),
W83-01307 5D

HYOGO PREFECTURE ENVIRONMENTAL SCIENCE INST., KOBE (JAPAN).
Anionic Surfactant Concentration in the River and Sea Waters of Hyogo Pref. and its Relationship to Phosphorus Concentration, (In Japanese),
W83-01152 5B

ILLINOIS INST. OF NATURAL RESOURCES, CHAMPAIGN.
Raindrop Axial Ratios,
W83-01092 2B

ILLINOIS STATE WATER SURVEY DIV., CHAMPAIGN.
Usefulness of Sediment Oxygen as a Tool for Impoundment Management,
W83-01371 5B

ILLINOIS UNIV. AT THE MEDICAL CENTER, CHICAGO. SCHOOL OF PUBLIC HEALTH.
Models of Particle Dry Deposition to a Lake Surface and Some Effects of Surface Microlayers,
W83-01267 5B

ILLINOIS UNIV. AT URBANA CHAMPAIGN. DEPT. OF GEOLOGY.
Chemical Osmosis, Reverse Chemical Osmosis, and the Origin of Subsurface Brines,
W83-01143 2K

INGENIEUR-BURO UNGER, DAMSTADT (GERMANY, F.R.).
Optimized Energy Exploitation through Aerobic-Anaerobic Two-Phase Stabilization (Optimierte Energieausnutzung Durch die Aerob-Anaerob Zweiphasen-Stabilisation),
W83-01304 5D

INGENIEURBOURO, MUNICH (GERMANY, F.R.).
Dam Kleine Kinzig - Design and Construction (Talsperre Kleine Kinzig - Entwurf Und Ausfuhrung),
W83-01110 8D

INSTITUT RUDJER BOSKOVIC, ZAGREB (YUGOSLAVIA). CENTER FOR MARINE RESEARCH.
Influence of Kinetics on the Direct Titration Curves of Natural Water Systems - Theoretical Considerations,
W83-01388 5A

INSTITUTE FOR MARINE ENVIRONMENTAL RESEARCH, PLYMOUTH (ENGLAND).
Laboratory Simulation of Chemical Processes Induced by Estuarine Mixing: The Behaviour of Iron and Phosphate in Estuaries,
W83-01120 2L

A Note on Tidal Asymmetry in the Severn Estuary,
W83-01134 2L

Primary Production in a Turbid Estuary,
W83-01155 2L

INSTITUTE OF OCEANOGRAPHIC SCIENCES, BIRKENHEAD (ENGLAND).
Mathematical Model for Partially Mixed Estuaries Using the Turbulence Energy Equation,
W83-01133 2L

INSTITUTE OF PAPER CHEMISTRY, APPLETON, WI.
Shifts in Caddisfly Species Composition in Sacramento River Invertebrate Communities in the Presence of Heavy Metal Contamination,
W83-01382 5C

INSTITUTE OF TERRESTRIAL ECOLOGY, HUNTINGDON (ENGLAND). MONKS WOOD EXPERIMENTAL STATION.
The Distribution of Lead, Zinc and Cadmium in Sediments of an Ore-Enriched Lotic Ecosystem, the River Ecclesbourne, Derbyshire,
W83-01073 5B

INTERNATIONAL LAB. OF MARINE RADIOACTIVITY, MONTE CARLO (MONACO). OCEANOGRAPHIC MUSEUM.
The Deposition of Windscale Radiocaesium in the Wyre Estuary and the Measurement of Sedimentation Rates,
W83-01138 5B

IOWA STATE UNIV., AMES. DEPT. OF AGRICULTURAL ENGINEERING.
High-Density Use of Septic Systems, Avon Lake, Iowa,
W83-01082 5D

JAMES COOK UNIV. OF NORTH QUEENSLAND, TOWNSVILLE (AUSTRALIA).
An Assessment of the Importance of Some Parameters for Seawater Intrusion in Aquifers and a Comparison of Dispersive and Sharp-Interface Modelling Approaches,
W83-01051 2F

JOENSUU UNIV. (FINLAND). KARELIAN INST.
Recent Increase in Mercury Sedimentation in a Forest Lake Attributable to Peatland Drainage,
W83-01393 5B

JOHN NUVEEN AND CO., INC., CHICAGO, IL.
Creative Financing Techniques for Water Utilities,
W83-01056 6C

JOHNS HOPKINS UNIV., BALTIMORE, MD. CHESAPEAKE BAY INST.
On the Use of the Nephelometer in Estuarine Waters,
W83-01135 5A

JOHNS HOPKINS UNIV., BALTIMORE, MD. DEPT. OF GEOGRAPHY AND ENVIRONMENTAL ENGINEERING.
Mathematical Model for Dissolved Oxygen in Three Southern Ontario Reservoirs,
W83-01227 5B

KAGOSHIMA UNIV. (JAPAN). FACULTY OF ENGINEERING.
Computer Evaluation of Sprinkler Irrigation Uniformity,
W83-01290 3F

KANSAS STATE UNIV., MANHATTAN. DEPT. OF AGRICULTURAL ENGINEERING.
Conservation Tillage Effects on Water Conservation,
W83-01240 3F

KENTUCKY UNIV., LEXINGTON. DEPT. OF AGRICULTURAL ENGINEERING.
The Influence of Atmospheric Nitrogen Influx Upon the Stream Nitrogen Profile of a Relatively Undisturbed Forested Watershed,
W83-01059 5B

KIEV STATE UNIV. (USSR). INST. OF FLUID MECHANICS.
Dynamics of the Foreshore of a Large Aggradational Feature in the Northwestern Black Sea,
W83-01095 2J

KONSTANZ UNIV. (GERMANY, F. R.) LIMNOLOGY INST.
Recent Investigations on the Eutrophication and Restoration of Lake Constance (Neuere Untersuchungen Uber Die Eutrophierung Und Sanierung Des Bodensees),
W83-01321 5G

LAHMEYER INTERNATIONAL G.M.B.H., FRANKFURT AM MAIN (GERMANY, F.R.).
Expansion Planning of Water Supply Projects in Tegucigalpa, Honduras (Ausbauplanung Von Wasserversorgungsprojekten in Tegucigalpa, Honduras),
W83-01343 6A

LAHTI MUNICIPAL LAB. (FINLAND).
The Recovery of L. Vesijarvi Following Sewage Diversion,
W83-01158 5G

LANCASTER UNIV., BAILRIGG (ENGLAND). DEPT. OF ENVIRONMENT SCIENCES.
An Improved Method of Determining Sedimentation Rates by the Use of Artificial Radionuclides,
W83-01153 2J

LAVAL UNIV. (QUEBEC). DEPT. OF MECHANICAL ENGINEERING.
Axial Flow-Induced Vibrations in Large High-Head Machines,
W83-01311 8C

LAWRENCE LIVERMORE NATIONAL LAB., CA.
Organic Contaminants in Groundwater Near an Underground Coal Gasification Site in Northeastern Wyoming,
W83-01066 5B

LEAGUE OF NEBRASKA MUNICIPALITIES, LINCOLN.
Water Regulations,
W83-01144 6E

LEHMAN BROS. KUHN LOEB, INC., NY.
The Role of Investment Banking Firms in Managing Water Project Financing,
W83-01081 6C

LENINGRAD TECHNOLOGICAL INSTI. (USSR).
Saturated Vapor Pressure of Water and Activity Coefficients of Calcium Chloride in the CaCl2-H20 System at 423-623K,
W83-01250 1A

LIVERPOOL UNIV. (ENGLAND). DEPT. OF APPLIED MATHEMATICS AND THEORETICAL PHYSICS.
The Effect of Aspect Ratio on Longitudinal Diffusivity in Rectangular Channels,
W83-01115 8B

LOS ALAMOS NATIONAL LAB., NM.
Control by Alkaline Neutralization of Trace Elements in Acidic Coal Cleaning Waste Leachates,
W83-01075 5G

LOUISIANA STATE UNIV., BATON ROUGE. CENTER FOR WETLAND RESOURCES.
Accumulation of Plant Nutrients and Heavy Metals Through Sedimentation Processes and Accretion in a Louisiana Salt Marsh,
W83-01125 2L

LOUISIANA WATER RESOURCES RESEARCH INST., BATON ROUGE.
An Investigation into the Removal of Algae by Fine Sand/Silt Filtration,
W83-01367 5D

LUND UNIV. (SWEDEN). LIMNOLOGICAL INST.
Changes in the Phytoplankton of Lake Trummen Induced by Restoration,
W83-01159 5G

MAINE UNIV. AT ORONO. DEPT. OF PLANT AND SOIL SCIENCES.
Effectiveness of Septic Systems in Safeguarding the Groundwater in Maine,
W83-01278 5G

MANAWATU CATCHMENT BOARD (NEW ZEALAND).
Fences for Floodways,
W83-01148 4A

MANHATTAN COLL., BRONX, NY. DEPT. OF ENVIRONMENTAL ENGINEERING AND SCIENCE.
Calculated Contribution of Surface Microlayer PCB to Contamination of Lake Michigan Lake Trout,
W83-01258 5B

MANHATTAN COLL., BRONX, NY. ENVIRONMENTAL ENGINEERING AND SCIENCE PROGRAM.
Reversible and Resistant Components of PCB Adsorption-Desorption: Adsorbent Concentration Effects,
W83-01264 5B

MARINE BIOLOGICAL ASSOCIATION OF THE UNITED KINGDOM, PLYMOUTH (ENGLAND). PLYMOUTH LAB.
Statistical Analysis of Estuarine Profiles: Application to Manganese and Ammonium in the Tamar Estuary,
W83-01154 2L

MARINE BIOLOGICAL LAB., WOODS HOLE, MA. ECOSYSTEMS CENTER.
Accumulation of the Polychlorinated Biphenyl Aroclor 1242 from Contaminated Detritus and Water by the Saltmarsh Detritivore, UCA Pugnax,
W83-01394 5B

MARYLAND UNIV., SOLOMONS, CENTER FOR ENVIRONMENTAL AND ESTUARINE STUDIES.
Simulating the Lateral Transport of Ichthyoplankton in the Potomac Estuary,
W83-01136 2L

MASSACHUSETTS INST. OF TECH., CAMBRIDGE. DEPT. OF EARTH AND PLANETARY SCIENCES.
Major Ion Chemistry of Some Large Chinese Rivers,
W83-01374 2K

MASSACHUSETTS UNIV., AMHERST. DEPT. OF PLANT AND SOIL SCIENCES.
The Septic Tank as a Wastewater Treatment and Disposal Facility,
W83-01241 5D

MASSACHUSETTS UNIV., AMHERST. DEPT. OF ZOOLOGY.
Use and Limitations of Sedimentary Pigments as Indicators of Past Lake Productivity,
W83-01237 5A

MASSACHUSETTS UNIV., AMHERST WATER RESOURCES RESEARCH CENTER.
Removal of Humic Substances and Turbidity in Water Supply Sources by Polymer Coagulation and Direct Filtration,
W83-01239 5F

METCALF AND EDDY, INC., BOSTON, MA.
Planning for Droughts,
W83-01347 6D

METEOROLOGICAL OFFICE, NEW DELHI (INDIA).
Application of Sacramento River Forecast Model to an Indian Catchment,
W83-01386 2A

Application of Deterministic Conceptual Model for Water Balance Studies,
W83-01387 2A

METROPOLITAN ST. LOUIS SEWER DISTRICT, MO.
Creation and Operation of the Metropolitan St. Louis Sewer District,
W83-01209 5D

Combined Sewers: Maintaining Yesterday's Infrastructure with Today's Technology,
W83-01211 5D

MIAMI UNIV., FL.
The Speciation of Ions in Tiber River Estuary Waters,
W83-01118 5B

MICHIGAN UNIV., ANN ARBOR. DEPT. OF ATMOSPHERIC AND OCEANIC SCIENCE.
Fractionation of Hydrophobic Origin Materials in Surface Microlayers,
W83-01266 5B

MICHIGAN UNIV., ANN ARBOR. GREAT LAKES RESEARCH DIV.
Enrichment of PCBs in Lake Michigan Surface Films,
W83-01259 5B

MINISTRY OF AGRICULTURE AND FISHERIES, ASHBURTON (NEW ZEALAND).
The Onflow of Irrigation Schemes,
W83-01318 3B

MINISTRY OF AGRICULTURE AND FISHERIES, AUCKLAND (NEW ZEALAND).
Tutira, A Lake Worth Restoring,
W83-01165 5G

MINISTRY OF AGRICULTURE AND FISHERIES AUCKLAND (NEW ZEALAND). FISHERIES MANAGEMENT DIV.
Ohiwa Harbour, Natural Values,
W83-01146 6G

MINISTRY OF AGRICULTURE AND FISHERIES (ENGLAND). FISHERIES RESEARCH LAB.
Grass Carp and Water Weed,
W83-01173 4A

MINISTRY OF ENERGY, SOFIA (BULGARIA).
Characteristics of a Low-Head Pressure Conduit,
W83-01286 8B

MINISTRY OF WORKS AND DEVELOPMENT, CHRISTCHURCH (NEW ZEALAND).
High Intensity Rainfalls in NZ,
W83-01295 2B

MINISTRY OF WORKS AND DEVELOPMENT (NEW ZEALAND).
Preventing Erosion, Landslip and Flooding, A Planning Approach,
W83-01147 6F

MINNESOTA UNIV., MINNEAPOLIS. DEPT. OF CHEMISTRY.
Progress Toward a Solution to the Nitrate Problem,
W83-01072 5F

MINNESOTA UNIV., MINNEAPOLIS. DEPT. OF CIVIL AND MINERAL ENGINEERING.
Overview of Atmospheric Inputs and Losses from Films,
W83-01246 5B

MINNESOTA UNIV., MINNEAPOLIS. DEPT. OF CIVIL AND MINING ENGINEERING.
Atmospheric Role in Trace Metal Exchange at the Air-Water Interface,
W83-01255 5B

MINNESOTA UNIV., MINNEAPOLIS. DEPT. OF ECOLOGY AND BEHAVIORAL BIOLOGY.
Short Cycling of Contaminants by Zooplankton and Their Impact on Great Lakes Ecosystems,
W83-01263 5B

MINNESOTA UNIV., MINNEAPOLIS. DEPT. OF ECOLOGY AND BEHAVIROAL BIOLOGY.
Overview of Contaminant Interactions with Surface Films, Zooplankton, and Fish,
W83-01257 5B

MINNESOTA UNIV., NAVARRE. GRAY FRESHWATER BIOLOGICAL INST.
Bacterial Enrichments in Surface Films of Freshwater Lakes,
W83-01261 2H

MISSISSIPPI STATE UNIV., MISSISSIPPI STATE. DEPT. OF CIVIL ENGINEERING.
Treatment Technology to Meet the Drinking Water Standards for Trihalomethanes for Jackson, Mississippi,
W83-01360 5F

MISSOURI UNIV.-COLUMBIA. DEPT. OF CIVIL ENGINEERING.
Influence of Particle Size Distribution on Water Quality in Agricultural Impoundments,
W83-01280 5B

MISSOURI UNIV., COLUMBIA. DEPT. OF GEOLOGY.
The Hydrogeology of Alluvial Aquifers in or Bordering the Dissected Till Plains,
W83-01269 2F

MONTANA UNIV., FLATHEAD LAKE. BIOLOGICAL STATION.
Algal Growth Stimulus by Phosphorus in Flathead Lake, Montana, Sediments,
W83-01065 5C

MORTON AND PARTNERS LTD., REXDALE (ONTARIO).
Application of Statistical Methods to Forecasting of Natural Groundwater Tables,
W83-01108 4B

MOSCOW STATE UNIV. (USSR). HDROPHYSICAL LAB.
Laboratory Investigation of the Structure of the Flow and Bottom Features in River Mouth Regions,
W83-01099 2E

MOSCOW STATE UNIV. (USSR). HYDROPHYSICAL LAB.
Laboratory Investigations of Methods of Protecting Supports from Local Scour,
W83-01098 8B

MUNICIPAL ENVIRONMENTAL RESEARCH LAB., CINCINNATI, OH.
Effect of Container Type on pH and Alkalinity Stability,
W83-01197 5A

NAGOYA UNIV. (JAPAN). DEPT. OF ENGINEERING.
Continuous Monitoring of Total and Inorganic Mercury in Wastewater and Other Waters,
W83-01380 5A

NALCO CHEMICAL CO., NAPERVILLE, IL.
Dynamics of Biofilm Processes,
W83-01080 5D

NATIONAL BUREAU OF STANDARDS, BOULDER, CO. NATIONAL ENGINEERING LAB.
Snow Stratography and Water Equivalence Measured with an Active Microwave System,
W83-01060 2C

NATIONAL ENVIRONMENTAL ENGINEERING RESEARCH INST., NAGPUR (INDIA).
Removal of Colour in Tertiary Treatment of Sanitary Sewage by Chemical Methods,
W83-01300 5D

NATIONAL HYDROLOGY RESEARCH INST., OTTAWA (ONTARIO).
An Alternative Conceptual Model of Groundwater Flow,
W83-01204 2F

NATIONAL MARINE FISHERIES SERVICE, OXFORD, MD.
Pathogenic Amoebae in Ocean Sediments Near Wastewater Sludge Disposal Sites,
W83-01216 5C

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, SEATTLE, WA. PACIFIC MARINE ENVIRONMENTAL LAB.
Relationships Between Organically Bound Cu Mn in Settling Particulate Matter and Biological Processes in a Subarctic Estuary,
W83-01126 2L

NATIONAL WATER RESEARCH INST., BURLINGTON (ONTARIO).
Deposition and Chemistry of Pollutant Metals in Lakes Around the Smelters at Sudbury, Ontario,
W83-01078 5B

Lake Erie Oxygen; The Prehistoric Record,
W83-01231 2H

NATIONAL WATER RESEARCH INST., VANCOUVER (BRITISH COLUMBIA).
Patterns of Circulation and Nutrient Supply in a Medium Residence-Time Reservoir Kootenay Lake, British Columbia,
W83-01223 2H

NEDERLANDS INST. VOOR ONDERZOEK DER ZEE, TEXEL. BIOLOGICAL RESEARCH EMS-DOLLART ESTUARY.
Influence of pH on the Fluorescence of Dissolved Organic Matter,
W83-01128 2L

NEW MEXICO STATE UNIV., LAS CRUCES. DEPT OF AGRONOMY.
Isolation and Control of Membrane Filter Degrading Microorganisms,
W83-01359 3A

NEW SOUTH WALES UNIV., KENSINGTON (AUSTRALIA). SCHOOL OF CIVIL ENGINEERING.
Stability Analysis of Water Movement in Unsaturated Porous Materials. I. Theoretical Considerations,
W83-01200 2G

NEW YORK STATE DEPT. OF HEALTH, ALBANY.
Overview of Microbiota in Surface Films,
W83-01265 5B

NEW YORK STATE DEPT. OF HEALTH, ALBANY. ENVIRONMENTAL HEALTH CENTER.
Effects of a Hexachlorobiphenyl and Pentachlorophenol on Growth and Photosynthesis of Phytoplankton,
W83-01242 5C

Overview of Phytoplankton Contaminant Problems,
W83-01243 5B

Microbiota in Surface Films: An Historical Perspective,
W83-01245 5B

NORTH CAROLINA STATE UNIV. AT RALEIGH. DEPT. OF BIOLOGICAL AND AGRICULTURAL ENGINEERING.
Fate of Polychlorinated Biphenyls (PCBs) in Soil Plant Systems,
W83-01235 5B

NORTH CAROLINA STATE UNIV. AT RALEIGH. DEPT. OF PSYCHOLOGY.
Water Resource Management and Conservation for the Future,
W83-01274 3D

An Investigation of Psychological Components of Water Conservation Behavior,
W83-01363 3D

NORTH CAROLINA UNIV. AT MOREHEAD CITY. INST. OF MARINE SCIENCES.
Environmental Factors Promoting and Regulating N2 Fixing Blue-Green Algal Blooms in the Chowan River, NC,
W83-01357 5C

NORTHERN ARIZONA UNIV., FLAGSTAFF. DEPT. OF MICROBIOLOGY.
Refinement of the Identification and Speciation Schemes of Fecal Streptococci,
W83-01365 5A

OAK RIDGE NATIONAL LAB., TN. ENVIRONMENTAL SCIENCES DIV.
Field and Laboratory Studies of the Toxicity of Phytoplankton of Polychlorinated Biphenyls (PCBs) Desorbed from Fine Clays and Natural Suspended Particulates,
W83-01244 5C

OKLAHOMA UNIV., KINGSTON. BIOLOGICAL STATION.
Water Renewal Effects on Reservoir Zooplankton Communities,
W83-01226 2H

ONTARIO HYDRO, TORONTO. DEPT. OF TRANSMISSION ENVIRONMENT.
An Analysis of Factors Influencing De-Icing Salt Levels in Streams,
W83-01088 5B

OREGON STATE UNIV., CORVALLIS.
Scheduling Irrigation by Computer,
W83-01166 3F

OREGON STATE UNIV., CORVALLIS. DEPT. OF ELECTRICAL AND COMPUTER ENGINEERING.
Stochastic Predictions of Sediment Yields from Small Coastal Watersheds in Oregon, U.S.A.,
W83-01053 2J

PENNSYLVANIA STATE UNIV., UNIVERSITY PARK. DEPT. OF AGRICULTURAL ENGINEERING.
Modified Graphical Determination of Submain Size,
W83-01101 8C

PENNSYLVANIA STATE UNIV., UNIVERSITY PARK. INST. FOR RESEARCH ON LAND AND WATER RESOURCES.
Chemical Interactions Between Forest Soils and Acidic Precipitation During a Dormant Season on Wildcat Run Watershed in Southwestern Pennsylvania,
W83-01236 2K

PENNSYLVANIA STATE UNIV., UNIVERSITY PARK. RESEARCH ON LAND AND WATER RESOURCES.
Design Considerations for Use of On-Site Sand Filters for Wastewater Treatment,
W83-01368 5D

PENNYSLVANIA STATE UNIV., UNIVERSITY PARK. DEPT. OF CIVIL ENGINEERING.
Evaluation of the Use of Iodine for Disinfection of Effluent from On-Site 'Package' Wastewater Treatment Systems,
W83-01361 5D

PETER SCHOLZ ING. G.M.B.H., KIRCHBERG/JAGST (GERMANY, F.R.).
Experience Report for Decentralized Wastewater Treatment (Erfahrungsbericht Mit Der Dezentralen Abwasserreinigung),
W83-01326 5D

PHYSICAL RESEARCH LAB., AHMEDABAD (INDIA).
A Conceptual Model of Water Transport Through Unsaturated Soil Zone,
W83-01376 2G

POLYTECHNIC INST. OF NEW YORK, BROOKLYN.
SRT Technique in Wastewater Process Design,
W83-01297 5D

PORT ELIZABETH UNIV. (SOUTH AFRICA). DEPT. OF ZOOLOGY.
Energy Flow in the Ythan Estuary, Aberdeenshire, Scotland,
W83-01122 2L

PRC TOUPS, ORANGE, CA.
Evaluation of Desalination Technology for Wastewater Reuse.
W83-01270 5D

PRETORIA UNIV. (SOUTH AFRICA). DEPT. OF CHEMISTRY.
Automated Prevalve Sample Filtration in Flow Injection Analysis: Determination of Sulphate in Water Removing Suspended Solids and Colour Before Sampling,
W83-01303 5A

PUERTO RICO UNIV. MAYAGUEZ. SCHOOL OF ENGINEERING.
Presence of Enteric Microorganisms in the Air Environment at Wastewater Treatment Plants in Puerto Rico,
W83-01272 5D

PUERTO RICO UNIV., MAYAGUEZ. WATER RESOURCES RESEARCH INST.
A Pricing Policy for Groundwater Management in Puerto Rico,
W83-01276 6C

PURDUE UNIV., LAFAYETTE, IN. DEPT. OF AGRICULTURAL ECONOMICS.
Efficiency of Resource Use Under Small-Scale Irrigation Technology in Nigeria,
W83-01083 6B

PURDUE UNIV., LAFAYETTE, IN. SCHOOL OF CIVIL ENGINEERING.
Statistical Characteristics of Some Indian Hydrologic Time Series,
W83-01385 2E

QUARLES AND BRADY, MILWAUKEE, WI.
Federal Common Law and its Application to Disputes Involving Accretive and Avulsive Changes in the Bounds of Navigable Waters,
W83-01160 6E

QUEEN MARY COLL., LONDON (ENGLAND). DEPT. OF GEOLOGICAL SCIENCE.
Results of Preliminary Experiments on the Influence of Fabrics on the Migration of Groundwater and Water-Soluble Minerals in the Capillary Fringe,
W83-01253 8G

QUEENSLAND DEPT. OF PRIMARY INDUSTRIES, WARWICK (AUSTRALIA).
Moisture Stress in Navy Beans. I. Effect of Withholding Irrigation at Different Phenological Stages on Growth and Yield,
W83-01289 3F

QUEENSLAND UNIV., BRISBANE (AUSTRALIA). DEPT. OF CIVIL ENGINEERING.
New Data on Shape Effects in Smooth Rectangular Channels,
W83-01221 8B

RENSSELAER POLYTECHNIC INST., TROY, NY. DEPT. OF CHEMICAL AND ENVIRONMENTAL ENGINEERING.
Dynamic Simulator for Anaerobic Digestion Processes,
W83-01105 5D

RHODE ISLAND UNIV., KINGSTON.
Environmental Improvement on Narragansett Bay as a Result of Section 312 Implementation of the Federal Water Pollution Control Act,
W83-01130 5G

RHODE ISLAND UNIV., KINGSTON. DEPT. OF BOTANY.
Nutrient Enrichment of Seagrass Beds in a Rhode Island Coastal Lagoon,
W83-01129 5C

RHODE ISLAND UNIV., KINGSTON, GRADUATE SCHOOL OF OCEANOGRAPHY.
Chemical Studies of Copper-Organic Complexes Isolated from Estuarine Waters Using C18 Reverse-Phase Liquid Chromatography,
W83-01139 5A

ROCKY MOUNTAIN FOREST AND RANGE EXPERIMENT STATION, FORT COLLINS, CO.
Stream Water Quality in a Small Commercial Campground in Colorado,
W83-01090 5B

RODNEY COUNTY COUNCIL (NEW ZEALAND).
Mahurangi, Problems of Management,
W83-01168 6G

ROYAL SIGNALS AND RADAR ESTABLISHMENT, MALVERN (ENGLAND). METEOROLOGICAL OFFICE RADAR RESEARCH LAB.
Radar and Raingauge Observations of Orographic Rain over South Wales,
W83-01061 2B

RUTGERS - THE STATE UNIV., NEW BRUNSWICK, NJ. DEPT. OF ZOOLOGY.
The Development of Phytoplankton Populations and Nutrients in a Tidal River Under Drought Conditions,
W83-01283 5B

SCIENCE AND EDUCATION ADMINISTRATION, MORRIS, MN.
Canopy Air Temperatures and Evapotranspiration from Irrigated and Stressed Soybeans,
W83-01313 2D

SCIENCE AND EDUCATION ADMINISTRATION, STONEVILLE, MS.
A Weighing Lysimeter for Use in Isolated Field Areas,
W83-01308 2G

SCIENTIFIC AND INDUSTRIAL RESEARCH, TAUPO (NEW ZEALAND), ECOLOGY DIV.
Limnology of Opal Lake,
W83-01116 2H

SEVERN-TRENT WATER AUTHORITY, BIRMINGHAM (ENGLAND).
Process Design of Anaerobic Sludge Digestion,
W83-01353 5D

SHERBROOKE UNIV. (QUEBEC). FACULTE DES SCIENCES APPLIQUEES.
Simulation of Fish Movements in a Large Hydro-Electric Reservoir: LG-2,
W83-01229 6G

SOLEXPERTS A.G., ZURICH (SWITZERLAND).
Measuring Station to Determine Pore Water Pressure - Zervreila Arch Dam (Messanlage Fur Porenwasserduck - Bogenstaumauer Zervreila),
W83-01100 8G

SOUTH CAROLINA UNIV., COLUMBIA.
The Structure of Two South Carolina Estuarine Tide Pool Fish Assemblages,
W83-01137 2L

SOUTH CAROLINA UNIV., COLUMBIA. DEPT. OF GEOLOGY.
Ground Water Geochemistry of 228Ra, 226Ra, and 222Rn,
W83-01157 5A

SOUTH DAKOTA STATE UNIV., BROOKINGS. DEPT. OF CIVIL ENGINEERING.
Seepage Ponds to Recycle Municipal Wastewater,
W83-01238 5D

SOUTHLAND CATCHMENT AND REGIONAL WATER BOARD (NEW ZEALAND).
The Effects of Mining Southland Lignite on Water and Soil Resources,
W83-01151 6G

SRI VENKATESWARA UNIV., TIRUPATI (INDIA). COLL. OF ENGINEERING.
Sorption of Phenol by Chemically Treated Flyash,
W83-01296 5D

Dynamic Equations for Steady Spatially Varied Open Channel Flow: A Critical Review,
W83-01395 8B

STATE UNIV. OF NEW YORK AT BINGHAMTON. DEPT. OF GEOLOGICAL SCIENCES.
The Dynamics of a River Bend: A Study in Flow and Sedimentary Processes,
W83-01249 2E

STATE UNIV. OF NEW YORK AT BUFFALO. DEPT. OF CHEMICAL ENGINEERING.
Fluidized-Bed Fermenters: A Steady-State Analysis,
W83-01106 5D

STRATHCLYDE REGIONAL COUNCIL (SCOTLAND). WATER DEPT.
Operational Experiences with a Pulsator Clarifier Treating a Coloured Upland Water,
W83-01302 5F

STUTTGART UNIV. (GERMANY, F.R.). INST. FUER SIEDLUNGWASSERBAU, WASSERGUTE- UND ABFALLWIRTSCHAFT.
Nitrogen Removal by Means of Preliminary Denitrification (Stickstoffelimination Durch Vorgeschaltete Denitrifikation),
W83-01324 5D

SULAIMANIYAH UNIV. (IRAQ). DEPT. OF BIOLOGY.
Some Diatoms from Brackish Water Habitats in Southern Iraq,
W83-01306 2L

Freshwater Red Algae A New Addition to the Iraqi Flora,
W83-01322 2H

TAKASAKI COLL. OF ECONOMICS, GUMMA (JAPAN).
Distributions of Heavy Metals in Bottom Mud and Polygonum Nodosum in the Watarase River (In Japanese),
W83-01175 5B

TAKASAKI COLL. OF ECONOMICS, GUMMA (JAPAN). CHEMICAL LAB.
Adsorption and Desorption of Heavy Metals in Bottom Mud of Urban Rivers,
W83-01194 5B

TARANAKI CATCHMENT COMMISSION (NEW ZEALAND).
Water to Play With,
W83-01172 6D

TECHNICAL UNIV., LODZ (POLAND). INST. OF GENERAL CHEMISTRY.
Spectrophotometric Determination of Aluminum in River Water with Bromopyrogallol Red and n-Tetradecyltrimethylammonium Bromide by Flow Injection Analysis,
W83-01389 5A

TECHNISCHE WERKE DER STADT STUTTGART A.G. (GERMANY, F.R.).
Correlation Procedures to Reduce Water Losses (Korrelationsverfahren Zur Wasserverlusminderung),
W83-01305 5F

TEXAS AGRICULTURAL EXTENSION SERVICE, COLLEGE STATION.
Sedimental Journey,
W83-01140 5E

TOKYO METROPOLITAN UNIV. (JAPAN). DEPT. OF CHEMISTRY.
High Abundance of Algal 24-Ethylcholesterol in Antarctic Lake Sediment,
W83-01373 2H

TORONTO UNIV. (ONTARIO). DEPT. OF BOTANY.
Effects of Artificial Conifer Foliage on Collection of Precipitation and Nutrients in Coastal British Columbia,
W83-01218 2I

TORONTO UNIV. (ONTARIO). DEPT. OF CHEMICAL ENGINEERING AND APPLIED CHEMISTRY.
Effects of Surface Films on Air-Water Exchange Rates,
W83-01262 5C

TORONTO UNIV. (ONTARIO). DEPT. OF GEOLOGY.
Geochemical Denudation Rates and Solute Transport Mechanisms in a Maritime Temperate Glacier Basin,
W83-01109 2C

TUEBINGEN UNIV. (GERMANY, F.R.). INST. FUER ORGANISCHE CHEMIE.
Quantitative Determination of Volatile Halogenated Hydrocarbons in Water Samples by Capillary Gas Chromatography and Electron Capture Detection,
W83-01338 5A

TURKU UNIV. (FINLAND). DEPT. OF BIOLOGY.
Enrichment of Copper, Zinc, Manganese, and Iron in Five Species of Pondweeks (Potamogeton Spp.),
W83-01392 5B

UNIVERSIDAD NACIONAL DEL ZULIA, MARACAIBO (VENEZUELA).
The Phytoplankton of Some Freshwater Bodies from Zulia State (Venezuela),
W83-01063 2H

UNIVERSITY COLL. OF NORTH WALES, BANGOR. MARINE SCIENCE LABS.
The Tidal Instrusion Front: An Estuarine Convergence Zone,
W83-01177 2L

UNIVERSITY OF NEW ENGLAND, ARMIDALE (AUSTRALIA). DEPT. OF AGRONOMY AND SOIL SCIENCE.
Irrigation for Crops in a Sub-Humid Environment, II. The Water Requirements of Soybeans,
W83-01314 2I

UP JAL NIGAM, HARDWAR (INDIA).
Infiltration Well Used In Hardwar Water Supply,
W83-01301 6B

UP JAL NIGAM, LUCKNOW (INDIA).
Low Cost Technology for Disposal of Human Excreta with Community Latrines,
W83-01319 5D

UTAH STATE UNIV., LOGAN. CROPS RESEARCH LAB.
A Greenhouse Line-Source Sprinkler System for Evaluating Plant Response to a Water Application Gradient,
W83-01162 3F

UTAH UNIV. RESEARCH INST., SALT LAKE CITY. EARTH SCIENCE LAB.
Fluid-Mineral Equilibria in a Hydrothermal System, Roosevelt Hot Springs, Utah,
W83-01142 2K

UTAH WATER RESEARCH LAB., LOGAN.
Evaluation of Microcosms for Determining the Fate and Effect of Benz(a)anthracene in Aquatic Systems,
W83-01282 5B

VELSICOL CHEMICAL CORP., CHICAGO, IL.
Photolysis of Hexachlorocyclopentadiene in Water,
W83-01079 5B

VERMONT STATE DEPT. OF HEALTH, BURLINGTON.
Acute Fluoride Poisoning Associated with an On-Site Fluoridator in a Vermont Elementary School,
W83-01329 5C

VICTORIA UNIV. OF MANCHESTER (ENGLAND). DEPT. OF GEOGRAPHY.
Sediment Fans and Sediment Flows Generated by Snowmelt: Observations at Austerdalsisen, Norway,
W83-01254 2J

VIRGINIA INST. OF MARINE SCIENCE, GLOUCESTER POINT.
In Situ Survival of Enteric Bacteria in Estuarine Environments of Different Nutrient Characteristics,
W83-01281 2L

VIRGINIA POLYTECHNIC INST. AND STATE UNIV., BLACKSBURG. DEPT. OF CIVIL ENGINEERING.
The Influence of Algal Growth and Other Ecological Factors in Reservoirs on the Production and Control of Trihalomethane Precursors,
W83-01279 5F

WAHNBACHTALSPERRENVERBAND, SIEGBURG (GERMANY, F.R.), ENGLISH SUMMARY.
Water Quality Assurance by Phosphorus Reduction in Drinking Water Reservoirs (Sicherung Der Trinkwassergute Als Folge Von Phosphoreliminierungsmassnahmen and Trinkwassertalsperren),
W83-01114 5F

WAIKATO UNIV., HAMILTON (NEW ZEALAND). DEPT. OF EARTH SCIENCES.
Sedimentation in an Artificial Lake - Lake Matahina, Bay of Plenty,
W83-01084 2J

WAIKATO VALLEY AUTHORITY, HAMILTON (NEW ZEALAND).
Soil Conservation Protects the Trout,
W83-01294 4D

WASHINGTON UNIV., SEATTLE. COLL. OF OCEAN AND FISHERIES SCIENCE.
Stable Density Fronts and Dinoflagellate Patches in a Tidal Estuary,
W83-01121 2L

WATERLOO UNIV. (ONTARIO). DEPT. OF EARTH SCIENCES.
Isotope Hydrogeology and Geothermometry of the Mount Meager Geothermal Area,
W83-01102 2F

Simulation of Long-Term Transient Density-Dependent Transport in Groundwater,
W83-01220 2F

WATERLOOPKUNDIG LAB, DELFT (NETHERLANDS).
Similarity Solutions of the Porous Media Equation,
W83-01058 2F

WEHRLE-WERKE A.G., EMMENDINGEN (GERMANY, F.R.).
Causes, Prevention and Control of Bulking Sludge in Activated Sludge Plants (Ursachen, Verhinderung Und Bekampfung Der Blahschlammbildung in Belebungsanlagen),
W83-01325 5D

WELLINGTON ACCLIMATISATION SOCIETY (NEW ZEALAND).
A Water Right for Fisheries,
W83-01293 6E

WINDSOR UNIV. (ONTARIO). DEPT. OF CIVIL ENGINEERING.
Alpha and Beta Factors for Domestic Wastewater,
W83-01207 5D

WINTER RAINFALL REGION, STELLENBOSCH (SOUTH AFRICA).
A Field Test of a Conceptual Computer Simulation Model for Predicting Water and Salt Distribution,
W83-01309 2G

WISCONSIN STATE LAB. OF HYGIENE, MADISON.
Determination of Total Kjeldahl Nitrogen and Total Phosphorus in Surface Waters and Wastewaters,
W83-01210 5A

WISCONSIN UNIV., MADISON, DEPT. OF CIVIL AND ENVIRONMENTAL ENGINEERING.
Trace Metal Accumulation in Surface Microlayers,
W83-01248 5B

WYOMING UNIV., LARAMIE. DEPT. OF AGRICULTURAL ENGINEERING.
The Selection of Fishery Parameters for Inclusion in the Stream Reach Inventory and Channel Stability Index,
W83-01364 6G

ZWECKVERBAND WASSERVERSORGUNG KLEINE KINZIG, FREUDENSTADT (GERMANY, F.R.).
Construction of the Dam to Supply Potable Water on the 'Kleine Kinzig' River Near Freudenstadt (Bauablauf an Der Trinkwassertalsperre Kleine Kinzig Bei Freudenstadt),
W83-01112 8D

ACCESSION NUMBER INDEX

W83-01051 2F
W83-01052 2F
W83-01053 2J
W83-01054 6C
W83-01055 6C
W83-01056 6C
W83-01057 2L
W83-01058 2F
W83-01059 5B
W83-01060 2C
W83-01061 2B
W83-01062 5D
W83-01063 2H
W83-01064 5C
W83-01065 5C
W83-01066 5B
W83-01067 5B
W83-01068 5B
W83-01069 5B
W83-01070 5G
W83-01071 5G
W83-01072 5F
W83-01073 5B
W83-01074 6E
W83-01075 5G
W83-01076 5D
W83-01077 5A
W83-01078 5B
W83-01079 5B
W83-01080 5D
W83-01081 6C
W83-01082 5D
W83-01083 6B
W83-01084 2J
W83-01085 5C
W83-01086 5C
W83-01087 5C
W83-01088 5B
W83-01089 5C
W83-01090 5B
W83-01091 7B
W83-01092 2B
W83-01093 6A
W83-01094 4A
W83-01095 2J
W83-01096 8B
W83-01097 2F
W83-01098 8B
W83-01099 2E
W83-01100 8G
W83-01101 8C
W83-01102 2F
W83-01103 2C
W83-01104 5B
W83-01105 5D
W83-01106 5D
W83-01107 5C
W83-01108 4B
W83-01109 2C
W83-01110 8D
W83-01111 8D
W83-01112 8D
W83-01113 2D
W83-01114 5F
W83-01115 8B
W83-01116 2H
W83-01117 2L
W83-01118 5B
W83-01119 2L
W83-01120 2L
W83-01121 2L
W83-01122 2L
W83-01123 5B
W83-01124 2L
W83-01125 2L
W83-01126 2L
W83-01127 5C
W83-01128 2L
W83-01129 5C
W83-01130 5G
W83-01131 5C
W83-01132 2L
W83-01133 2L
W83-01134 2L
W83-01135 5A
W83-01136 2L
W83-01137 2L
W83-01138 5B
W83-01139 5A
W83-01140 5E
W83-01141 5G
W83-01142 2K
W83-01143 2K
W83-01144 6E
W83-01145 3F
W83-01146 6G
W83-01147 6F
W83-01148 4A
W83-01149 5B
W83-01150 5G
W83-01151 6G
W83-01152 5B
W83-01153 2J
W83-01154 2L
W83-01155 2L
W83-01156 4A
W83-01157 5A
W83-01158 5G
W83-01159 5G
W83-01160 6E
W83-01161 2J
W83-01162 3F
W83-01163 2L
W83-01164 6E
W83-01165 5G
W83-01166 3F
W83-01167 6E
W83-01168 6G
W83-01169 4D
W83-01170 8A
W83-01171 6D
W83-01172 6D
W83-01173 4A
W83-01174 6G
W83-01175 5B
W83-01176 2L
W83-01177 2L
W83-01178 7C
W83-01179 7C
W83-01180 7C
W83-01181 7C
W83-01182 5C
W83-01183 7C
W83-01184 7C
W83-01185 7C
W83-01186 7C
W83-01187 10C
W83-01188 7C
W83-01189 5B
W83-01190 7C
W83-01191 5G
W83-01192 4C
W83-01193 4A
W83-01194 5B
W83-01195 5C
W83-01196 5A
W83-01197 5A
W83-01198 5D
W83-01199 5C
W83-01200 2G
W83-01201 2K
W83-01202 2B
W83-01203 4D
W83-01204 2F
W83-01205 2F
W83-01206 2K
W83-01207 5D
W83-01208 5E
W83-01209 5D
W83-01210 5A
W83-01211 5D
W83-01212 5A
W83-01213 2G
W83-01214 5B
W83-01215 5E
W83-01216 5C
W83-01217 5C
W83-01218 2I
W83-01219 5C
W83-01220 2F
W83-01221 8B
W83-01222 5B
W83-01223 2H
W83-01224 2H
W83-01225 6G
W83-01226 2H
W83-01227 5B
W83-01228 6G
W83-01229 6G
W83-01230 2H
W83-01231 2H
W83-01232 4A
W83-01233 2E
W83-01234 8A
W83-01235 5B
W83-01236 2K
W83-01237 5A
W83-01238 5D
W83-01239 5F
W83-01240 3F
W83-01241 5D
W83-01242 5C
W83-01243 5B
W83-01244 5C
W83-01245 5B
W83-01246 5B
W83-01247 5B
W83-01248 5B
W83-01249 2E
W83-01250 1A
W83-01251 2K
W83-01252 2J
W83-01253 8G
W83-01254 2J
W83-01255 5B
W83-01256 5B
W83-01257 5B
W83-01258 5B
W83-01259 5B
W83-01260 5B
W83-01261 2H
W83-01262 5C
W83-01263 5B
W83-01264 5B
W83-01265 5B
W83-01266 5B
W83-01267 5B
W83-01268 2H
W83-01269 2F
W83-01270 5D
W83-01271 6C
W83-01272 5D
W83-01273 5B
W83-01274 3D
W83-01275 5D
W83-01276 6C
W83-01277 3A
W83-01278 5G
W83-01279 5F
W83-01280 5B
W83-01281 2L
W83-01282 5B
W83-01283 5B
W83-01284 8B
W83-01285 8B
W83-01286 8B
W83-01287 8B
W83-01288 3F
W83-01289 3F
W83-01290 3F
W83-01291 6G
W83-01292 5A
W83-01293 6E
W83-01294 4D
W83-01295 2B
W83-01296 5D
W83-01297 5D
W83-01298 5D
W83-01299 5D
W83-01300 5D
W83-01301 6B
W83-01302 5F
W83-01303 5A
W83-01304 5D
W83-01305 5F
W83-01306 2L
W83-01307 5D
W83-01308 2G
W83-01309 2G
W83-01310 5B
W83-01311 8C
W83-01312 8C
W83-01313 2D
W83-01314 2I
W83-01315 6D
W83-01316 8G
W83-01317 6G
W83-01318 3B
W83-01319 5D
W83-01320 5C
W83-01321 5G
W83-01322 2H
W83-01323 5D
W83-01324 5D
W83-01325 5D
W83-01326 5D
W83-01327 5D
W83-01328 6G
W83-01329 5C
W83-01330 6C
W83-01331 5F
W83-01332 4A
W83-01333 8A
W83-01334 5E
W83-01335 5F
W83-01336 5E
W83-01337 6E
W83-01338 5A
W83-01339 5D
W83-01340 8C
W83-01341 5B
W83-01342 7A
W83-01343 6A
W83-01344 5G
W83-01345 5F
W83-01346 5G
W83-01347 6D
W83-01348 4A
W83-01349 5F
W83-01350 3B
W83-01351 5D
W83-01352 3A
W83-01353 5D
W83-01354 5C
W83-01355 5B
W83-01356 7A
W83-01357 5C
W83-01358 6B
W83-01359 3A
W83-01360 5F
W83-01361 5D
W83-01362 5A
W83-01363 3D
W83-01364 6G
W83-01365 5A
W83-01366 4B
W83-01367 5D
W83-01368 5D
W83-01369 3A
W83-01370 3A
W83-01371 5B
W83-01372 2H
W83-01373 2H
W83-01374 2K
W83-01375 5C
W83-01376 2G
W83-01377 2B
W83-01378 2F
W83-01379 5A
W83-01380 5A
W83-01381 5A
W83-01382 5C
W83-01383 5C
W83-01384 7A
W83-01385 2E
W83-01386 2A

W83-01387

W83-01387 2A
W83-01388 5A
W83-01389 5A
W83-01390 5C
W83-01391 5B
W83-01392 5B
W83-01393 5B
W83-01394 5B
W83-01395 8B
W83-01396 5B
W83-01397 7C
W83-01398 7C
W83-01399 7C
W83-01400 7C

☆ U. S. GOVERNMENT PRINTING OFFICE : 1983 381-011/10

Subject Fields

- NATURE OF WATER
- WATER CYCLE
- WATER SUPPLY AUGMENTATION AND CONSERVATION
- WATER QUANTITY MANAGEMENT AND CONTROL
- WATER QUALITY MANAGEMENT AND PROTECTION
- WATER RESOURCES PLANNING
- RESOURCES DATA
- ENGINEERING WORKS
- MANPOWER, GRANTS, AND FACILITIES
- SCIENTIFIC AND TECHNICAL INFORMATION

INDEXES

- SUBJECT INDEX
- AUTHOR INDEX
- ORGANIZATIONAL INDEX
- ACCESSSION NUMBER INDEX

POSTAGE AND FEES PAID
U.S. DEPARTMENT OF COMMERCE
COM-211

Special Fourth Class Rate
Book

U.S. DEPARTMENT OF COMMERCE
National Technical Information Service
5285 Port Royal Road
Springfield VA 22161

OFFICIAL BUSINESS

PRINTED MATTER

AN EQUAL OPPORTUNITY EMPLOYER

NORTH AMERICAN CONTINENT PRICE SCHEDULE

Customers in Canada, United States, and Mexico please use this price schedule; other addressees, write for Folder PR-360-4.

MICROFICHE				
A01	$4.50	E01	$6.50	T01 $175.00
PAPER COPY		E02	7.50	T02 140.00
		E03	9.50	T03 240.00
A02	7.00	E04	11.50	T04 320.00
A03	8.50	E05	13.50	T05 400.00
A04	10.00	E06	15.50	T06 465.00
A05	11.50	E07	17.50	T07 530.00
A06	13.00	E08	19.50	T08 595.00
A07	14.50	E09	21.50	T09 660.00
A08	16.00	E10	23.50	T10 725.00
A09	17.50	E11	25.50	T11 790.00
A10	19.00	E12	28.50	T12 855.00
A11	20.50	E13	31.50	T13 920.00
A12	22.00	E14	34.50	T14 985.00
A13	23.50	E15	37.50	T15 1,050.00
A14	25.00	E16	40.50	T16 1,115.00
A15	26.50	E17	43.50	T17 1,180.00
A16	28.00	E18	46.50	T18 1,245.00
A17	29.50	E19	51.50	T19 1,310.00
A18	31.00	E20	61.50	T99 **
A19	32.50	E99	**	
A20	34.00			
A21	35.50	N01	35.00	
A22	37.00	N02	40.00	
A23	38.50			
A24	40.00	*Add $1.50 for each additional 25 page increment, or portion thereof		
A25	41.50	**Contact NTIS for price quote		
A99	*			

PRICES EFFECTIVE JANUARY 1, 1983

BOUND BY
HM

UNIVERSITY OF ILLINOIS-URBANA
3 0112 084233185